

Mission Impact Generalized Explanatory Base Operating Support Model Development

FINAL REPORT – DETAILED TECHNICAL AUDIT

June 1981

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) GEBOS-M can compute Air Force Major Command (MAJCOM) BOS and RPMA manpower requirements directly from programmed changes in mission elements. It provides manpower managers with a quick turnaround capability to program and justify base level support manpower changes in functional category level of detail, tied directly to changes in mission capability. This test model applies to Strategic		

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20.(continued) Air Command (SAC), Tactical Air Command (TAC), and Air Training Command (ATC)/U.S. Air Force Academy (USAFA). With further work, it can be extended to apply Air Force-wide. Initial validation tests were completed. They demonstrated consistent and reliable relationships between primary mission activities and their supporting BOS/RPMA workload and manpower levels. The supporting manpower and workload elements addressed by the model include all Department of Defense (DOD) functional categories comprising the BOS/RPMA program elements. This report provides detailed technical information on the research conducted, documentation of the GEBOS-M model, and a procedural guide for operation of the model and replication of the analysis results.

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SECTION 1
INTRODUCTION

This report provides a procedural guide and detailed technical audit of the research performed by General Research Corporation (GRC) under contract F33615-80-C-0023, "Development of a Mission Impact Generalized Explanatory Base Operating Support Model" (GEBOS-M). It documents the research methodology and details the analysis results. Both are discussed in the depth necessary to enable others to reproduce those results and understand the operation of the model. That presentation follows this brief introduction and is organized as follows:

- Section 2 discusses data collection and preliminary data analysis procedures that were used to assess data consistency.
- Section 3 describes the analysis of manpower and workload that was performed to develop the manpower/workload relationships and workload interrelationships used in the GEBOS-M model.
- Section 4 reviews the analysis of mission capabilities and the derivation of mission/support workload relationships that serve as key computational links between mission and base operating support (BOS)/real property maintenance (RPMA) workload indicators in the model.
- Section 5 provides documentation of the GEBOS-M interactive computer model, including descriptions of the programs, operating instructions, input files, and computational methodology.
- Section 6 discusses validation results, including sensitivity analyses, historical validation, and comparisons to other model estimates.

Because a fundamental purpose of this report is to provide documentation in sufficient detail to permit Air Force scientists to replicate GRC's work, we have listed below each of the other items containing

technical details delivered to the Air Force (other than monthly reports and presentation/briefing materials) under the current contract as well as its predecessors. Our objectives in doing so are: to minimize the need for redundancy in the current report and to extend the technical audit of the GEBOS effort to the beginnings of our work in mid-1978 as an aid to full understanding.

<u>Current Contract Deliverable</u>	<u>GRC Identifier</u>	<u>Date</u>
Final Management Summary	Report Number 1205-01-81-CR	June 1981
Technical Report Analysis Condensation Evaluation (TRACE)	Report Number 2105-02-81-CR	May 1981
Computer Software/Computer Program/Computer Data Base Configuration (one magnetic data tape copy for installa- tion and one card deck- FORTRAN)	GRC Letter of Transmittal 81-388	10 June 1981
Magnetic Tape Data File of all data collected, with accompanying layout	GRC Letter of Transmittal 81-388	10 June 1981
<u>Prior Contract Deliverable</u>	<u>GRC Identifier</u>	<u>Date</u>
Development of a Generalized Explanatory Base Operating Support (GEBOS) Model	Report Number 1112-01-79-CR	January 1980
Pilot Program to Develop Aggregate Base Operating Support Workload Indicators for Use in Air Staff Level Manpower Management	Report Number 1059-01-79-CR	March 1979

1.1 PROJECT OVERVIEW

Every year, the Directorate of Manpower and Organization (AF/MPM), Headquarters, United States Air Force, must define and assess the impact of BOS and RPMA manpower changes in terms of reduced or increased workload and mission execution capabilities. This occurs on a routine basis as the Five Year Defense Program (FYDP) is developed, updated, and revised. It frequently occurs on an emergent basis when the Air Force manpower program is presented and defended to the Office of the Secretary

of Defense (OSD), the Office of Management and Budget (OMB), and the committees of the Congress.

Historically, AF/MPM has estimated these so-called support manpower impacts based upon percentage factors applied to mission manpower changes. Such an approach effectively treats all mission manpower elements as equivalent in terms of their requirement for BOS and RPMA support. A B-52 squadron and a headquarters unit authorized identical manpower levels have the same support manpower needs under such a system. Further, the system only estimates changes at the program element level. Such a program element factor method does not address manpower needs in any functional detail. No consistent, regularized estimate is made as to how functional manpower categories will be affected or how their workload output levels can be expected to change.

Initial research by GRC led to the development, in cooperation with the Air Force Management Engineering Agency (AFMEA), of innovative program estimating equations which identified a series of aggregate manpower/workload indicator relationships. These were used to build an explanatory model capable of accurately estimating the impact of workload changes on BOS and RPMA functional manpower; or, alternatively, the impact of manpower changes in terms of workload execution capability. Initially, these programming tools were not correlated with mission manpower or mission execution capabilities.

The current research and model building effort identified the key relationships between mission manpower and capabilities, and the primary BOS and RPMA manpower and workload indicators. These relationships have enabled GRC to complete and test a programmable mission/support manpower planning model. Given specific mission changes, the GEBOS-M model can accurately estimate changes to primary workload indicators and BOS and RPMA manpower by functional category.

1.2 CURRENT CONTRACT REQUIREMENTS

The period of performance covered by this report was 1 December 1980 through 30 June 1981. It was dedicated to extending GRC's innovative prior work in developing a prototype GEBOS model.

The contract specifications for the current effort required GRC to perform 7 months of research divided into four phases:

- Phase I. Identify three test major commands (MAJCOMs); and identify, collect, and refine those MAJCOM data elements necessary to construct the computerized data base supporting GEBOS-M.
- Phase II. Develop the GEBOS-M model. Analyze manpower, workload, and mission capability to develop and refine their interactive relationships. Develop the automated capability to selectively change mission structure and concurrently compute base operating support workload and manpower impacts in functional detail.
- Phase III. Develop model validation procedures. Conduct validation exercises comparing model output to the manpower/workload/mission impact results of actual changes in mission elements of the force structure.
- Phase IV. Provide (throughout the contract term) full documentation and briefings on computer software, data files, model operation/output, a technical audit trail, and a non-technical management summary suitable for publication detailing major findings of the whole effort.

1.3 GRC RESEARCH APPROACH

In executing the just described contract elements, a two-phased research effort was required to develop a model capable of programming BOS requirements associated with force structure mission changes. First, the relationship between BOS/RPMA manpower and major workload indicators was explored and refined to identify reliable and consistent estimates of the BOS/RPMA manpower required to perform essential workloads. Then

the interaction between these key support workload indicators and principal mission activities was investigated to develop consistent relationships between primary mission activities and their supporting BOS/RPMA workload and manpower levels.

This research approach was carried out in the following steps:

- Identification of BOS/RPMA manpower categories in three test commands: Strategic Air Command (SAC), Tactical Air Command (TAC), and Air Training Command (ATC).
- Identification of candidate BOS/RPMA workload indicators in the test commands.
- Selection of a set of workload indicators which, when changed, accurately and reliably "explain" changes in BOS/RPMA manpower.
- Identification of principal mission activities and associated manpower within the test commands.
- Derivation of consistent and reliable relationships between primary mission activities/manpower and the previously identified explanatory BOS/RPMA workload indicators.
- Derivation of other consistent explanatory relationships that exist among related workload indicators.
- Accounting for so-called "support-on-support" manpower needs.

The following sections detail the manner in which each element of this research approach was executed.

SECTION 2

DATA COLLECTION AND INITIAL DATA ANALYSIS

A key step in the performance of the research on this project was the collection of accurate and reliable data on support manpower, support workload, and mission capability measures. These data were necessary to correctly identify logical relationships between mission and support and to accurately quantify these relationships in a manner that is useful for Air Force manpower planners.

This section is divided into two parts. The first part discusses the data collection effort. The second part provides a review and analysis of the data, including certain data validation procedures conducted by GRC.

2.1 DATA COLLECTION

Definition of BOS/RPMA Functional Categories

DOD defines ten functional categories which include manpower and which fall into the RPMA (xxx94) and BOS (xxx96) program element codes. Table 2.1 defines the Air Force functional account codes that comprise these ten DOD functional categories.

GRC's prior contract research dealt with the seven DOD functional categories in the BOS program element. The current effort expanded that prior work to include the three DOD functional categories in the RPMA program element. The inclusion of the RPMA program element provides GEBOS-M with comprehensive coverage of the BOS/RPMA functional categories of interest to OSD and assures the comparability of GEBOS-M equation results with BOS/RPMA program factor studies done by AFMEA. As in our prior BOS work, the manpower and workload data needed by GRC to develop functional equations in RPMA were provided by AFMEA.

TABLE 2.1
AIR FORCE FUNCTIONAL ACCOUNT CODES (FACs)
BY DOD BOS/RPMA FUNCTIONAL CATEGORIES

<u>DOD Functional Category*</u>	<u>FACs Included</u>
30 - Maintenance and Repair of Real Property	44XX (less: 4400, 4401, 4402, 4406, 4410, 4425, 4426, 4427, 4461, 4463, 4466, 4467, 4490, 4491, 4492, 4493, 4494)
32 - Operation of Utilities for All Real Property	4461, 4463, 4466, 4467, 4491
33 - Other Engineering Support	4400, 4401, 4402, 4406, 4410, 4425, 4426, 4427, 4490, 4492, 4493, 4494
36 - Administration	10XX, 11XX, 12XX, 13XX, 14XX, 15XX, 16XX, 17XX, 18XX, 19XX (less: 125X, 105X)
37 - Retail Supply Operations	135X, 41XX
38 - Maintenance of Installation Equipment	2XXX, 424X
39 - Other Base Services	30XX, 31XX, 32XX, 33XX, 34XX, 35XX, 36XX, 37XX, 38XX, 39XX, 40XX, 42XX, 43XX, 46XX, 47XX, 48XX, 49XX, 5XXX, 6XXX, 7XXX (less: 424X, 462X, 4650, 4651, 466X, 467X, 468X)
40 - Bachelor Housing and Furnishings	4650, 4651
41 - Morale, Welfare, and Recreation	45XX
42 - Other Personnel Support	105X, 462X, 466X, 467X, 468X

* DOD Functional Category 31 - Minor Construction is a part of the BOS/
RPMA grouping but is not listed here since manpower authorizations are
not included in DOD FC 31.

Bases

Table 2.2 lists the Air Force bases on which data were collected for analysis in ATC, SAC, and TAC. The computer codes used in GRC's data files for the MAJCOMs and bases are also included.

Two changes in the base listings have occurred since 1978. The US Air Force Academy was added to the ATC list on an experimental basis at the request of the Headquarters USAF Directorate of Manpower and Organization (AF/MPMZ) representative. This conforms with the inclusion of the Academy by the Air Force Management Engineering Agency (AFMEA) in the ATC estimating equations. Also, selected activities in the city of San Antonio have been included in the ATC list to account for their contribution to RPMA manpower in support of functions at Randolph and Lackland AFBs.

Data Accessions List

Appendix A contains a data accessions list which identifies BOS and RPMA manpower collected, workload indicators, mission capability measures, and sources for all data.

Variables

Table 2.3 lists the variables stored in the computer file along with their respective computer codes. Table 2.4 identifies variables compiled from the primary variables with their respective computer codes and computational formulas.

Statistical Analysis Data Base

Appendix B contains the statistical analysis data base. It lists data base formats and presents detailed data for the variables and bases described above.

2.2 INITIAL DATA ANALYSIS

Detailed Review of Manpower and Workload Data

Early in the development of GEBOS-M, a review was made of the base level manpower and workload data to determine its completeness, identify

TABLE 2.2
BASES BY COMMAND

<u>ATC (1)</u>	<u>SAC (2)</u>	<u>TAC (3)</u>
1. Chanute	1. Andersen	1. Bergstrom
2. Columbus	2. Barksdale	2. Cannon
3. Goodfellow	3. Beale	3. Davis Monthan
4. Keesler	4. Blytheville	4. England
5. Lackland	5. Carswell	5. George
6. Laughlin	6. Castle	6. Holloman
7. Lowry	7. Dyess	7. Homestead
8. Mather	8. Ellsworth	8. Howard
9. Maxwell	9. F. E. Warren	9. Eglin/Hurlburt
10. Randolph	10. Fairchild	10. Langley
11. Reese	11. Grand Forks	11. Luke
12. San Antonio	12. Griffiss	12. MacDill
13. Sheppard	13. Grissom	13. Moody
14. Williams	14. K. I. Sawyer	14. Mountain Home
15. USAF Academy	15. Loring	15. Myrtle Beach
16. Vance	16. Malmstrom	16. Nellis
	17. March	17. Seymour Johnson
	18. McConnell	18. Shaw
	19. Minot	
	20. Offutt	
	21. Pease	
	22. Plattsburgh	
	23. Rickenbacker	
	24. Vandenberg	
	25. Whiteman	
	26. Wurtsmith	

Note: Data for each base listed were entered into GRC's computer data base using the numerical codes shown above for the individual bases by MAJCOM. For example, the computer code for TAC's Bergstrom AFB was "3,1". See text for summary of basis for inclusion in the ATC listing of the USAF Academy at Colorado Springs, and selected activities in the city of San Antonio.

TABLE 2.3
VARIABLES IN THE COMPUTER DATA BASE

V1 COMMAND/
V2 BASE/
V3 FC30 RPMA/
V4 FC32 UTILITIES/
V5 FC33 OTHER ENG SUPPT/
V6 FC36 ADMINISTRATION/
V7 FC37 SUPPLY/
V8 FC38 INST MAINTENANCE/
V9 FC39 OTHER BASE SERVICES/
V10 FC40 BACH HOUSING/
V11 FC41 MWR/
V12 FC42 OTHER PERSONNEL SUPPT/
V15 TOTAL BASE OFFICERS/
V16 TOTAL BASE AIRMEN/
V17 TOTAL BASE CIVILIANS/
V18 TOTAL BASE CMYES/
V19 MILITARY FAMILY HOUSING UNITS/
V20 MILITARY HOUSING FLOOR SPACE/
V21 BASE TOTAL FLOOR SPACE/
V22 BASE TOTAL BUILDINGS/
V23 HEATING CAPACITY-BTU/
V26 AIR CONDITIONING CAPACITY/
V27 ELECTRIC POWER CAPACITY/
V28 DRINKING WATER CAPACITY/
V29 TRAVEL TRANSACTIONS/
V30 DISTILLATES/
V31 RESIDUALS/
V32 GASOLINE/
V33 AVIATION FUEL/
V34 SUPPLY TRANSACTIONS/
V37 EQUIPMENT TRANSACTIONS/
V38 SUPPLY ITEM RECORDS/
V39 EQUIPMENT ITEM RECORDS/
V40 VEHICLES ON HAND/
V41 VEHICLES AUTHORIZED/
V42 VISITING AIRMEN BEDS/
V43 VISITING AIRMEN FLOOR SPACE/
V44 VISITING OFFICER BEDS/
V45 VISITING OFFICER FLOOR SPACE/

TABLE 2.3 (Continued)

V48 TRAINING BUILDINGS/
 V49 TRAINING FLOOR SPACE/
 V50 TOTAL SQUADRONS ASSIGNED/
 V51 TOTAL COMBAT SQUADRONS ASSIGNED/
 V52 AIRCRAFT ASSIGNED/
 V53 TOTAL TRAINING COSTS/
 V54 ELECTRICITY CONSUMPTION -MWHR-/
 V55 OIL CONSUMPTION -MBTU-/
 V56 COAL CONSUMPTION -MBTU-/
 V59 TOTAL LAND AREA/
 V60 TOTAL BUILDING AREA/
 V61 TOTAL BOS BUDGET/
 V62 END FY 79 AFTA PERSONNEL/
 V63 FY 79 TOTAL POPULATION/
 V64 FY 79 MISSION POPULATION/
 V65 END FY 79 BOS PERSONNEL/
 V66 END FY 79 POPULATION SUPPORTED/
 V67 TOTAL FY 79 TRAINING PERSONNEL/
 V70 DORMITORY BEDS/
 V71 DORMITORY FLOOR SPACE/
 V72 WEIGHTED RATIONS /
 V73 MILITARY VEHICLES/
 V74 TOTAL VEHICLES/
 V75 VEHICLE EQUIVALENTS/
 V76 MILES DRIVEN/
 V77 AVERAGE DAILY LOAD OF STUDENTS/
 V78 TOTAL ANNUAL OUTPUT OF STUDENTS/
 V81 NATURAL GAS CONSUMPTION/
 V82 PROPANE GAS CONSUMPTION/
 V83 TOTAL ENERGY CONSUMPTION/
 V84 TOTAL ENERGY COST/
 V85 TRANSACTIONS AUDITED/
 V86 TOTAL AIR FORCE MEMBERS/
 V87 CIVILIAN PAY ACCOUNTS/
 V88 COMMERCIAL SERVICE TRANSACTIONS/
 V89 MATERIEL TRANSACTION WORKLOAD/
 V90 BASE NUMBER/
 V91 TOTAL STUDENTS AUTHORIZED/
 V92 UPT BASES/
 V93 TOTAL SORTIES/
 V94 ESTIMATED AVIATION FUEL CONS/
 V95 MILITARY VEHICLES-ATC/
 V96 TOTAL VEHICLES-ATC/
 V97 MILES DRIVEN-ATC/

TABLE 2.4
COMPUTED VARIABLES

C1 TOTAL BASE POPULATION/
C2 TOTAL BASE POPULATION INCL CMYES/
C3 TOTAL MILITARY POPULATION/
C4 TOTAL GROUND FUEL CONSUMPTION/
C5 NONHOUSING FL SP/
C6 TOTAL TRANSACTIONS/
C7 TOTAL ITEM RECORDS/

C1= V15+V16+V17
C2 = V15+V16+V17+V18
C3 = V15 + V16
C4= V30 + V31 + V32
C5 = V21 - V20
C6 = V34 + V37
C7 = V38 + V39

anomalous data observations, and for reference purposes. Tables 2.5, 2.6, and 2.7 summarize the results of this review for SAC, TAC, and ATC. The manpower and functional categories are listed, along with the computer file reference name. Statistics are also provided on the number of valid observations, the mean, minimum, and maximum values.

Tables 2.8 and 2.9 list the functional manpower distributions by command for RPMA and BOS. The RPMA aggregate functional manpower distributions are similar for the three commands. Several significant differences exist in the BOS functional category manpower distribution for ATC as opposed to SAC and TAC. For example, ATC contains proportionally more manpower in Other Personnel Support and much less in Retail Supply Operations.

Table 2.10 illustrates the changes in BOS functional manpower between FY78 and FY79 for the three test commands. No aggregate functional patterns were evident. In only one function (Bachelor Housing) did all three commands experience consistent changes in direction, if not in proportion. Total BOS manpower declined for SAC and increased slightly in ATC and TAC.

Workload Data

Workload data were provided by AFMEA and collected by GRC from additional sources. Duplication of selected workload data provided validity checks on key workload items. One such item that was checked against two sources was base population.

AFMEA provided data on total officers, airmen, Federal civilians, and contract manyear equivalents (CMYEs) by installation. The sum of these four items produces the base population (less dependents) estimate. The Domestic Base Factors Report also contains an estimate of base population that includes total full-time military and civilian personnel and contractors. These two population estimates were both made as of the end of FY79 and should approximate each other.

TABLE 2.5

SAC MANPOWER AND WORKLOAD DATA

a. Manpower Data

DoD Functional Category	Computer Name	Valid Observations	Mean			Minimum		Maximum	
30-Maintenance and Repair of Real Property	V3	26	324.9	195.0	667.0				
32-Operation of Utilities for All Real Property	V4	26	72.5	43.0	108.0				
33-Other Engineering Support	V5	26	106.0	79.0	256.0				
36-Administration	V6	26	273.2	208.0	738.0				
37-Retail Supply Operations	V7	26	298.2	187.0	374.0				
38-Maintenance of Installation Equipment	V8	26	85.8	45.0	176.0				
39-Other Base Services	V9	26	287.0	213.0	535.0				
40-Bachelor Housing Operations and Furnishings	V10	26	12.5	8.0	21.0				
41-Morale, Welfare, and Recreation	V11	26	34.8	24.0	58.0				
42-Other Personnel Support	V12	26	95.4	38.0	166.0				

TABLE 2.5 (Continued)

b. Workload Indicator Data

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Total base officers	V15	26	703.3	203.0	3,259.0
Total base airmen	V16	26	3,510.1	1,599.0	8,498.0
Total base civilians	V17	26	736.6	362.0	2,926.0
Total base contract manyear equivalents	V18	26	140.3	9.0	1,687.0
Military family housing units	V19	26	809.2	290.0	2,115.0
Military family housing floor space	V20	26	2,036.2	1,023.0	4,297.0
Base total buildings	V22	26	1,119.1	519.0	3,157.0
Base total floor space	V21	26	4,771.2	2,461.0	9,455.0
Heating capacity (in BTUs)	V23	26	9,014.7	1,140.0	28,868.0
Air conditioning capacity	V26	26	3,266.9	0.0	16,488.0
Electric power capacity	V27	26	4,064.4	735.0	13,673.0
Drinking water capacity	V28	26	218.5	8.0	614.0
Travel transactions	V29	26	4,083.7	2,228.0	13,876.0
Distillates	V30	26	651.8	319.0	1,226.0
Residuals	V31	26	834.8	0.0	6,310.0
Gasoline	V32	26	1,085.9	67.0	6,589.0
Aviation fuel	V33	26	2,811.0	11.0	6,384.0
Supply transactions	V34	26	52,810.2	25,913.0	83,456.0
Equipment transactions	V37	26	7,276.3	3,746.0	10,642.0
Supply item records	V38	26	5,689.5	2,951.0	8,656.0
Equipment item records	V39	26	1,030.7	660.0	1,776.0
Vehicles on hand	V40	26	1,356.2	321.0	20,472.0

TABLE 2.5 (Continued)

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Vehicles authorized	V41	26	553.0	313.0	809.0
Visiting airmen beds	V42	26	67.3	0.0	348.0
Visiting airmen floor space	V43	26	17.7	0.0	98.0
Visiting officer beds	V44	26	76.0	4.0	332.0
Visiting officer floor space	V45	26	32.4	2.0	137.0
Dormitory beds	V70	26	1,602.0	910.0	2,425.0
Dormitory floor space	V71	26	337.8	145.0	634.0
Weighted rations	V72	26	16,325.3	8,251.0	27,390.0
Total land area	V59	24	15,958.9	3,013.0	73,425.0
Total building area	V60	24	4,724.8	2,460.0	9,466.0
Total BOS budget	V61	24	27,696.5	18,959.0	44,329.0
End FY 79 authorized full-time assigned personnel	V62	24	5,151.9	2,980.0	13,918.0
End FY 79 total population	V63	24	5,569.4	3,006.0	13,992.0
End FY 79 mission population	V64	24	3,654.6	1,653.0	10,559.0
End FY 79 BOS personnel	V65	24	1,914.8	1,353.0	3,433.0
End FY 79 population supported	V66	24	23,898.7	11,779.0	64,505.0
Military vehicles	V73	26	5.6	0.0	28.0
Total vehicles	V74	26	617.1	328.0	940.0
Vehicle equivalents	V75	26	1,322.9	739.0	2,080.0
Miles driven	V76	26	3,508.5	1,340.0	8,428.0
Transactions audited	V85	25	20,368.6	4,032.0	46,679.0
End FY 79 total Air Force members	V86	25	4,799.0	2,696.0	11,999.0
Civilian pay accounts	V87	25	845.2	326.0	3,405.0

TABLE 2.5 (Continued)

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Commercial service transactions	V88	25	3,256.1	1,508.0	8,910.0
Material transaction workload	V89	25	958.7	288.0	1,997.0
Electricity consumption MWHR	V54	25	68,760.0	28,565.0	155,174.0
Oil consumption MBTU	V55	25	236,018.8	97,464.0	529,454.0
Coal consumption MBTU	V56	25	59.8	0.0	716.0
Natural gas consumption	V81	25	367.3	0.0	1,097.0
Propane gas consumption	V82	25	2,830.2	0.0	21,673.0
Total energy consumption	V83	25	931.0	361.0	1,660.0
Total energy cost	V84	25	2,994.1	1,300.0	6,357.0

TABLE 2.6

TAC MANPOWER AND WORKLOAD DATA

a. Manpower Data

<u>DoD Functional Category</u>	<u>Computer Name</u>	<u>Valid Observations</u>	<u>Mean</u>	<u>Minimum</u>	<u>Maximum</u>
30-Maintenance and Repair of Real Property	V3	17	318.9	172.0	737.0
32-Operation of Utilities for All Real Property	V4	17	64.4	33.0	93.0
33-Other Engineering Support	V5	17	122.9	68.0	223.0
36-Administration	V6	18	258.2	137.0	363.0
37-Retail Supply Operations	V7	18	328.3	223.0	441.0
38-Maintenance of Installation Equipment	V8	18	60.1	39.0	84.0
39-Other Base Services	V9	18	254.6	125.0	463.0
40-Bachelor Housing Operations and Furnishings	V10	16	12.9	8.0	26.0
41-Morale, Welfare, and Recreation	V11	18	35.7	39.0	44.0
42-Other Personnel Support	V12	18	103.4	64.0	199.0

TABLE 2.6 (Continued)

b. Workload Indicator Data

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Total base officers	V15	18	644.8	201.0	1,827.0
Total base airmen	V16	18	4,008.6	1,463.0	7,192.0
Total base civilians	V17	18	746.7	335.0	1,550.0
Total base contract manyear equivalents	V18	18	179.8	28.0	768.0
Military family housing units	V19	17	621.0	134.0	1,264.0
Military family housing floor space	V20	17	1,589.4	398.0	2,672.0
Base total buildings	V22	17	914.0	348.0	1,671.0
Base total floor space	V21	17	3,920.4	1,683.0	6,118.0
Heating capacity (in BTUs)	V23	17	3,674.0	1,132.0	10,955.0
Air conditioning capacity	V26	16	5,084.0	0.0	25,643.0
Electric power capacity	V27	17	6,237.2	1,752.0	12,045.0
Drinking water capacity	V28	16	146.6	41.0	736.0
Travel transactions	V29	18	4,560.7	2,073.0	14,239.0
Distillates	V30	18	485.8	227.0	918.0
Residuals	V31	18	315.1	0.0	2,941.0
Gasoline	V32	18	505.7	49.0	1,210.0
Aviation fuel	V33	18	3,040.7	634.0	6,239.0
Supply transactions	V34	18	76,883.8	36,914.0	119,265.0
Equipment transactions	V37	18	10,998.9	4,961.0	18,535.0
Supply item records	V38	18	7,304.5	4,105.0	11,231.0
Equipment item records	V39	18	1,085.4	764.0	1,743.0
Vehicles on hand	V40	18	644.7	295.0	1,398.0

TABLE 2.6 (Continued)

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Vehicles authorized	V41	18	627.1	290.0	1,282.0
Visiting airmen beds	V42	18	92.4	0.0	495.0
Visiting airmen floor space	V43	18	22.8	0.0	111.0
Visiting officer beds	V44	18	93.8	0.0	218.0
Visiting officer floor space	V45	18	47.2	0.0	117.0
Dormitory beds	V70	18	1,569.8	0.0	2,934.0
Dormitory floor space	V71	18	311.0	0.0	508.0
Weighted rations	V72	18	18,570.3	10,715.0	30,684.0
Total land area	V59	17	7,299.6	670.0	50,694.0
Total building area	V60	17	3,709.0	1,676.0	5,355.0
Total BOS budget	V61	17	34,446.3	20,011.0	50,995.0
End FY 79 authorized full-time assigned personnel	V62	17	5,967.5	3,286.0	11,050.0
End FY 79 total population	V63	17	6,138.1	3,286.0	11,126.0
End FY 79 mission population	V64	17	4,145.5	1,825.0	7,895.0
End FY 79 BOS personnel	V65	17	1,992.5	1,173.0	3,231.0
End FY 79 population supported	V66	17	30,293.9	8,624.0	164,169.0
Military vehicles	V73	18	27.6	1.0	123.0
Total vehicles	V74	18	516.4	321.0	808.0
Vehicle equivalents	V75	18	1,078.5	658.0	1,725.0
Miles driven	V76	18	2,064.8	1,241.0	3,556.0
Transactions audited	V85	18	22,299.6	14,720.0	44,576.0
End FY 79 total Air Force members	V86	18	5,199.7	1,990.0	9,519.0
Civilian pay accounts	V87	17	896.6	398.0	1,962.0

TABLE 2.6 (Continued)

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Commercial service transactions	V88	18	3,949.5	2,328.0	5,983.0
Material transaction workload	V89	18	1,035.2	450.0	2,007.0
Electricity consumption MWHR	V54	17	61,178.8	28,500.0	101,800.0
Oil consumption MBTU	V55	17	210,742.0	97,242.0	347,342.0
Coal consumption MBTU	V56	16	20.0	0.0	320.0
Natural gas consumption	V81	17	203.3	0.0	644.0
Propane gas consumption	V82	17	1,688.2	0.0	5,500.0
Total energy consumption	V83	17	536.8	208.0	1,038.0
Total energy cost	V84	17	3,223.9	1,352.0	6,043.0

TABLE 2.7

ATC MANPOWER AND WORKLOAD DATA

a. Manpower Data

<u>DoD Functional Category</u>	<u>Computer Name</u>	<u>Valid Observations</u>	<u>Mean</u>	<u>Minimum</u>	<u>Maximum</u>
30-Maintenance and Repair of Real Property	V3	15	303.7	29.0	1081.0
32-Operation of Utilities for All Real Property	V4	13	80.8	17.0	350.0
33-Other Engineering Support	V5	16	105.2	9.0	187.0
36-Administration	V6	16	306.9	36.0	554.0
37-Retail Supply Operations	V7	14	218.9	6.0	342.0
38-Maintenance of Installation Equipment	V8	15	54.6	10.0	117.0
39-Other Base Services	V9	16	216.8	18.0	416.0
40-Bachelor Housing Operations and Furnishings	V10	13	17.7	3.0	31.0
41-Morale, Welfare, and Recreation	V11	15	37.9	5.0	77.0
42-Other Personnel Support	V12	15	184.2	7.0	912.0

TABLE 2.7 (Continued)

b. Workload Indicator Data

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Total base officers	V15	16	665.3	33.0	1,651.0
Total base airmen	V16	16	2,156.2	232.0	4,964.0
Total base civilians	V17	16	1,487.3	144.0	4,028.0
Total base contract manyear equivalents	V18	16	427.1	2.0	1,718.0
Military family housing units	V19	15	527.4	30.0	1,065.0
Military family housing floor space	V20	15	1,305.9	87.0	2,423.0
Base total buildings	V22	16	781.9	2.0	1,424.0
Base total floor space	V21	16	4,474.8	24.0	9,921.0
Heating capacity (in BTUs)	V23	13	1,242.1	0.0	2,170.0
Air conditioning capacity	V26	14	2,618.9	0.0	16,610.0
Electric power capacity	V27	13	7,525.0	0.0	22,186.0
Drinking water capacity	V28	13	960.5	1.0	10,776.0
Travel transactions	V29	13	5,912.9	1,652.0	10,219.0
Distillates	V30	13	266.7	146.0	510.0
Residuals	V31	13	23.2	0.0	247.0
Gasoline	V32	13	258.2	27.0	859.0
Aviation fuel	V33	13	1,501.0	0.0	6,951.0
Supply transactions	V34	13	47,842.9	22,971.0	69,475.0
Equipment transactions	V37	13	5,550.6	3,083.0	8,825.0
Supply item records	V38	13	4,772.6	2,270.0	8,399.0
Equipment item records	V39	13	908.0	627.0	1,181.0
Vehicles on hand	V40	15	455.0	83.0	2,035.0

TABLE 2.7 (Continued)

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Vehicles authorized	V41	15	320.1	84.0	585.0
Visiting airmen beds	V42	14	421.6	0.0	1,504.0
Visiting airmen floor space	V43	14	96.9	0.0	299.0
Visiting officer beds	V44	16	162.6	0.0	1,070.0
Visiting officer floor space	V45	16	69.6	0.0	357.0
Dormitory beds	V70	16	3,664.5	0.0	22,839.0
Dormitory floor space	V71	16	788.1	0.0	4,171.0
Weighted rations	V72	16	49,424.7	0.0	350,054.0
Total land area	V59	15	5,063.4	1,119.0	18,325.0
Total building area	V60	15	4,744.4	1,018.0	9,848.0
Total BOS budget	V61	15	32,785.8	12,164.0	52,378.0
End FY 79 authorized full-time assigned personnel	V62	15	4,923.7	1,280.0	9,437.0
End FY 79 total population	V63	15	7,489.1	1,990.0	22,323.0
End FY 79 mission population	V64	15	5,574.4	1,295.0	19,546.0
End FY 79 BOS personnel	V65	15	2,121.8	695.0	5,407.0
End FY 79 population supported	V66	15	24,914.6	4,889.0	113,440.0
Military vehicles	V73	15	10.4	0.0	105.0
Total vehicles	V74	15	313.1	82.0	673.0
Vehicle equivalents ^a	V75	-			
Miles driven	V76	15	1,491.5	377.0	2,894.0
Transactions audited	V85	14	25,869.8	8,216.0	53,453.0
End FY 79 total Air Force members	V86	14	5,298.9	1,144.0	14,537.0
Civilian pay accounts	V87	13	1,905.5	142.0	4,986.0

^aData not available.

TABLE 2.7 (Continued)

	Computer Name	Valid Observations	Mean	Minimum	Maximum
Commercial service transactions	V88	14	4,513.6	1,902.0	10,394.0
Material transaction workload	V89	14	1,067.6	49.0	2,502.0
Electricity consumption MWHR	V54	15	62,673.9	16,206.0	143,188.0
Oil consumption MBTU	V55	15	213,844.5	55,295.0	488,577.0
Coal consumption MBTU	V56	13	78.4	0.0	1,019.0
Natural gas consumption	V81	15	442.1	0.0	1,138.0
Propane gas consumption	V82	15	1,378.9	0.0	8,222.0
Total energy consumption	V83	15	794.1	128.0	1,622.0
Total energy cost	V84	15	2,901.5	648.0	6,646.0

TABLE 2.8

PE XXX94 - FY79 MANPOWER DISTRIBUTIONS FOR RPMA BY
FUNCTIONAL CATEGORY BY COMMAND

DOD Functional Category	Command					
	ATC	%	SAC	%	TAC	%
Maintenance and Repair of Real Property (30)	4,555	61.6	8,448	64.5	5,422	63.1
Operation of Utilities for Real Property (32)	1,160	15.7	1,884	14.4	1,088	12.7
Other Engineering Support (33)	<u>1,683</u>	<u>22.7</u>	<u>2,757</u>	<u>21.1</u>	<u>2,089</u>	<u>24.2</u>
Total	7,398	100.0	13,089	100.0	8,599	100.0

TABLE 2.9

PE XXX96 - FY79 MANPOWER DISTRIBUTIONS FOR BOS BY
FUNCTIONAL CATEGORY BY COMMAND

DOD Functional Category	Command					
	ATC	%	SAC	%	TAC	%
Administration (36)	4,911	31.0	7,104	25.2	4,648	24.5
Retail Supply Operations (37)	3,064	19.4	7,753	27.4	5,910	31.3
Maintenance of Installation Equipment (38)	819	5.2	2,232	7.9	1,082	5.7
Other Base Services (39)	3,469	21.9	7,463	26.4	4,582	24.2
Bachelor Housing Operations (40)	230	1.5	324	1.1	207	1.1
Morale, Welfare and Recreation (41)	569	3.6	906	3.2	642	3.4
Other Personnel Support (42)	<u>2,763</u>	<u>17.4</u>	<u>2,481</u>	<u>8.8</u>	<u>1,862</u>	<u>9.8</u>
Total	15,825	100.0	28,263	100.0	18,933	100.0

TABLE 2.10

CHANGES IN BOS MANPOWER FROM FY78 TO FY79 FOR EACH
DOD FUNCTIONAL CATEGORY BY COMMAND

DOD Functional Category	Manpower					
	1978 ATC	1979 ATC*	Change 78-79	1978 SAC	1979 SAC	Change 78-79
Administration (36)	4,607	4,531	-1.6	7,049	7,104	1.0
Retail Supply Operations (37)	3,027	2,907	-4.0	7,900	7,753	-1.9
Maintenance of Installation Equipment (38)	652	776	19.0	2,179	2,232	2.4
Other Base Services (39)	3,069	3,266	6.4	7,822	7,463	-4.6
Bachelor Housing Operations (40)	241	218	-9.5	332	324	-2.4
Morale, Welfare and Recreation (41)	542	530	-2.2	903	906	0.3
Other Personnel Support (42)	2,678	2,691	0.5	2,720	2,481	-8.8
Total	14,816	14,919	0.7	28,905	28,263	-2.2
				18,791	18,933	0.8

* Excludes USAF Academy manpower (included on an experimental basis in other ATC FY 1979 data in this paper at the request of the AF/MPMZ representative) to allow comparison with FY 1978 data.

Tables 2.11, 2.12, and 2.13 compare the two sets of population estimates for SAC, TAC, and ATC. In general, the two estimates are quite close, and differences usually are less than 200. However, in several cases, particularly for TAC, the differences are substantial, often over 2000. Such major discrepancies clearly indicated that selected base data were invalid. GRC resolved these differences through AF/MPMZ prior to performing detailed workload analyses using the AFMEA base population data. The corrected figures were: Cannon, 4394; Homestead, 6090; Mountain Home, 4635; Shaw, 5975.

Aggregate Workload Indicators

Tables 2.14, 2.15, and 2.16 provide a comparative FY78-FY79 display of command-level workload indicator totals for SAC, TAC, and ATC. These aggregate workload indicators provided the primary descriptive data for the workload capability displays produced from GEOBS-M. FY78 data were collected during our earlier work in developing the BOS-oriented GEBOS model--prior to including RPMA with BOS, and adding mission impact capabilities under the current effort. The FY79 aggregate workload levels provided the combined BOS/RPMA workload benchmarks for GEBOS-M model testing.

These aggregate workload indicator tables do allow limited comparisons of FY79 indicators with selected FY78 workload data. Percent changes in aggregate workload between FY78 and FY79 are shown. Some of these do not represent valid comparisons. It must be emphasized that not all workload items are directly comparable between the two years. As previously noted, the earlier GEBOS model was based on BOS manpower/workload only--while GEBOS-M is expanded to use both BOS and RPMA manpower/workload. Because of this effective change in content and definition, mission population aggregates for FY78 and FY79 are not comparable (i.e., in FY78, RPMA was included in mission manpower; in FY79, it was not).

Further, supply workload indicators, particularly item records, had undergone definition changes between FY78 and FY79. Total population supported (including dependents) from the Domestic Base Factors

TABLE 2.11
COMPARISON OF SAC BASE POPULATION ESTIMATES

Base	AFMEA	DBFR	Difference
	End FY79 Authorized Manpower and CMYE (From Sources 1 and 2)	End FY79 Authorized Full Time Assigned Personnel and Contractors (From Source 10)	
Andersen	4,283	---	---
Barksdale	6,311	6,484	-173
Beale	4,692	4,726	-34
Blytheville	2,991	3,006	-15
Carswell	5,609	5,687	-78
Castle	6,092	6,083	9
Dyess	5,422	5,453	-31
Ellsworth	6,686	6,734	-48
F. E. Warren	4,166	4,191	-25
Fairchild	4,557	4,805	-248
Grand Forks	5,646	5,753	-107
Griffiss	6,732	6,911	-179
Grissom	2,834	2,980	-146
K. I. Sawyer	4,144	4,167	-23
Loring	4,059	4,066	-7
Malmstrom	5,095	5,028	67
March	5,132	5,140	-8
McConnell	3,912	4,208	-296
Minot	6,426	6,072	354
Offutt	13,792	13,918	-126
Pease	3,902	4,056	-154
Plattsburgh	4,267	4,289	-22
Rickenbacker	2,561	3,029	-468
Vandenberg	7,362	---	---
Whiteman	3,655	3,666	-11
Wurtsmith	3,157	3,194	-37

TABLE 2.12
COMPARISON OF TAC BASE POPULATION ESTIMATES

Base	AFMEA	DBFR	Difference
	End FY79 Authorized Manpower and CMYE (From Sources 1 and 2)	End FY79 Authorized Full Time Assigned Personnel and Contractors (From Source 10)	
Bergstrom	5,239	5,419	-180
Cannon*	1,723	4,607	-2,884*
Davis Monthan	6,285	6,324	-39
England	3,498	3,488	10
George	5,569	5,532	37
Holloman	6,764	6,952	-188
Homestead*	5,919	8,432	-2,513*
Howard	2,439	---	---
Hurlburt	3,785	3,805	-20
Langley	10,939	11,050	-111
Luke	7,575	7,301	274
MacDill	6,017	6,581	-564
Moody	3,366	3,422	-56
Mountain Home*	2,071	4,687	-2,616*
Myrtle Beach	3,255	3,286	-31
Nellis	9,067	8,714	353
Seymour Johnson	5,643	5,645	-2
Shaw*	3,948	6,203	-2,255*

* Data resolution through AF/MPMZ generated corrected data for these bases as outlined in the text.

TABLE 2.13
COMPARISON OF ATC BASE POPULATION ESTIMATES

<u>Base</u>	AFMEA	DBFR	<u>Difference</u>
	End FY79 Authorized Manpower and CMYE (From Sources 1 and 2)	End FY79 Authorized Full Time Assigned Personnel and Contractors (From Source 10)	
Chanute	4,445	4,340	105
Columbus	2,978	2,946	32
Goodfellow	1,152	1,280	-128
Keesler	8,389	8,323	66
Lackland	9,556	9,437	119
Laughlin	2,774	2,750	24
Lowry	7,684	7,863	-179
Mather	5,303	5,298	5
Maxwell	4,028	4,306	-278
Randolph	7,534	7,569	-35
Reese	2,688	2,696	-8
San Antonio	2,276	---	---
Sheppard	6,342	6,415	-73
Williams	3,422	3,430	-8
USAF Academy	4,390	4,551	-161
Vance	2,612	2,651	-39

TABLE 2.14
SAC AGGREGATE WORKLOAD INDICATORS

<u>Workload Indicator</u>	<u>FY 78 Value</u>	<u>FY 79 Value</u>	<u>Percent Change</u>
<u>Population</u>			
Total Population Supported (Including Dependents)	412,551	573,569	39.0
Base Population	136,491	132,349	-3.0
RPMA Manpower	---	13,089	---
BOS Manpower	28,905	28,263	-2.2
Military Population	111,643	109,548	-1.9
Mission Population	107,586	90,997	---
<u>Real Property Maintenance</u>			
Military Family Housing Units	---	21,040	---
Military Family Housing Floor Space	---	52,941	---
Base Total Buildings	---	29,097	---
Non-Housing Floor Space	---	71,110	---
Base Total Floor Space	---	124,051	---
<u>Utilities</u>			
BTU Heating Capacity	---	234,382	---
Air Conditioning Capacity	---	84,938	---
KWHR Capacity	---	105,674	---
Drinking Water Capacity	---	5,681	---
Total Energy Consumption (MBTU)	---	23,276	---
Electricity Consumption (MWHRS)	---	1,719,000	---
<u>Administration</u>			
Travel Transactions Processed	106,779	106,177	-0.6
BOS Budget	882,000	665,000	-24.6
Transactions Audited	610,702	509,216	-16.6
Leave and Pay Accounts	130,544	119,977	-8.1
Civilian Pay Records	21,510	21,130	-1.8
Materiel and Services Transactions	126,881	105,370	-17.0
Commercial Services Transactions	---	81,402	---
Materiel Transaction Workload	---	23,968	---

TABLE 2.14 (Continued)

<u>Workload Indicator</u>	<u>FY 78 Value</u>	<u>FY 79 Value</u>	<u>Percent Change</u>
<u>Supply</u>			
Total Transactions	2,842,420	---	---
Supply Transactions	2,376,568	1,373,066	-42.2
Equipment Transactions	193,415	189,185	-2.2
Total Inventory Item Records	1,084,387	---	---
Supply Item Records	921,863	147,926	-84.0
Equipment Item Records	162,524	26,797	-83.5
Aviation Fuel Consumption	79,346	73,087	-7.9
<u>Maintenance of Installation Equipment</u>			
Total Mileage	88,000	91,220	3.6
Total Vehicle Equivalents	33,201	34,395	3.6
Total Vehicles	14,601	16,044	9.9
Military Vehicles	---	145	---
Non-Military Vehicles	---	15,899	---
<u>Bachelor Housing</u>			
Dormitory Beds	41,837	41,651	-0.4
Dormitory Floor Space	9,395	8,782	-6.5
Visiting Airmen Beds	---	1,751	---
Visiting Airmen Floor Space	---	461	---
Visiting Officer Beds	---	1,976	---
Visiting Officer Floor Space	---	843	---
<u>Other Personnel Support</u>			
Weighted Rations Served	456,186	424,452	-7.0

TABLE 2.15
TAC AGGREGATE WORKLOAD INDICATORS

<u>Workload Indicator</u>	<u>FY 78 Value</u>	<u>FY 79 Value</u>	<u>Percent Change</u>
Total Population Supported (Including Dependents)	368,987	514,996	39.6
Base Population	101,551	100,436	-1.1
RPMA Manpower	---	8,599	---
BOS Manpower	18,791	18,933	0.8
Military Population	84,645	83,760	-1.0
Mission Population	82,760	72,904	---
<u>Real Property Maintenance</u>			
Military Family Housing Units	---	10,557	---
Military Family Housing Floor Space	---	27,019	---
Base Total Buildings	---	15,538	---
Non-Housing Floor Space	---	39,628	---
Base Total Floor Space	---	66,647	---
<u>Utilities</u>			
BTU Heating Capacity	---	62,459	---
Air Conditioning Capacity	---	81,345	---
KWHR Capacity	---	106,032	---
Drinking Water Capacity	---	2,345	---
Total Energy Consumption (MBTU)	---	9,125	---
Electricity Consumption (MWHRS)	---	1,040,039	---
<u>Administration</u>			
Travel Transactions Processed	84,562	82,092	-2.9
BOS Budget	570,000	586,000	2.8
Transactions Audited	425,233	401,392	-5.6
Leave and Pay Accounts	99,647	93,594	-6.1
Civilian Pay Records	14,978	15,242	1.8
Materiel and Services Transactions	87,098	89,725	3.0
Commercial Services Transactions	---	71,091	---
Materiel Transaction Workload	---	18,634	---

TABLE 2.15 (Continued)

<u>Workload Indicators</u>	<u>FY 78 Value</u>	<u>FY 79 Value</u>	<u>Percent Change</u>
<u>Supply</u>			
Total Transactions	2,616,625	1,581,875	-39.5
Supply Transactions	2,396,100	1,383,894	-42.2
Equipment Transactions	220,525	197,981	-10.2
Total Inventory Item Records	929,105	151,018	-83.7
Supply Item Records	812,221	131,481	-83.8
Equipment Item Records	116,884	19,537	-83.3
Aviation Fuel Consumption	45,291	54,733	20.8
<u>Maintenance of Installation Equipment</u>			
Miles Driven	---	37,167	---
Vehicle Equivalents	---	19,413	---
Total Vehicles	11,347	9,295	-18.1
Military Vehicles	---	497	---
Non-Military Vehicles	---	8,798	---
<u>Bachelor Housing Indicators</u>			
Dormitory Beds	32,138	28,256	-12.1
Dormitory Floor Space	6,881	5,398	-18.6
Visiting Officer Beds	---	1,688	---
Visiting Officer Floor Space	---	849	---
Visiting Airmen Beds	---	1,663	---
Visiting Airmen Floor Space	---	411	---
<u>Other Personnel Support</u>			
Weighted Rations Served	344,877	334,275	-3.1

TABLE 2.16
ATC AGGREGATE WORKLOAD INDICATORS

<u>Workload Indicator</u>	<u>FY 78 Value</u>	<u>FY 79 Value</u>	<u>Percent Change</u>
<u>Population</u>			
Total Population Supported (Including Dependents)	167,001	373,319	123.8
Base Population	67,997	75,772	11.4
RPMA Manpower	---	7,398	---
BOS Manpower	14,816	15,825	6.8
Military Population	41,727	45,143	8.3
Students	36,798	37,023	0.6
Mission Population	63,181	52,659	---
<u>Real Property Maintenance</u>			
Military Family Housing Units	---	7,911	---
Military Family Housing Floor Space	---	19,588	---
Base Total Buildings	---	12,510	---
Non-Housing Floor Space	---	52,008	---
Base Total Floor Space	---	71,596	---
<u>Utilities</u>			
BTU Heating Capacity	---	16,147	---
Air Conditioning Capacity	---	36,664	---
KWHR Capacity	---	97,825	---
Drinking Water Capacity	---	12,486	---
Total Energy Consumption (MBTU)	---	11,912	---
Electricity Consumption (MWHRS)	---	940,108	---
<u>Administration</u>			
Travel Transactions Processed	81,949	77,086	-5.9
BOS Budget	484,000	492,000	1.7
Transactions Audited	---	362,177	---
Leave and Pay Accounts	---	74,183	---
Civilian Pay Records	---	24,772	---
Materiel and Services Transactions	---	78,137	---
Commercial Services Transactions	---	63,190	---
Materiel Transaction Workload	---	14,947	---

TABLE 2.16 (Continued)

<u>Workload Indicator</u>	<u>FY 78 Value</u>	<u>FY 79 Value</u>	<u>Percent Change</u>
<u>Supply</u>			
Total Transactions	1,151,388	694,115	-39.7
Supply Transactions	1,062,509	621,957	-41.5
Equipment Transactions	88,879	72,158	-18.8
Total Inventory Item Records	453,401	73,848	-83.7
Supply Item Records	384,068	62,044	-83.8
Equipment Item Records	69,334	11,804	-83.0
Aviation Fuel Consumption	15,134	19,513	28.9
<u>Maintenance of Installation Equipment</u>			
Miles Driven	---	22,373	---
Total Vehicles	---	4,695	---
Military Vehicles	---	156	---
Non-Military Vehicles	---	4,539	---
<u>Bachelor Housing</u>			
Dormitory Beds	62,114	58,632	-5.6
Dormitory Floor Space	13,554	12,609	-7.0
Visiting Officer Beds	---	2,601	---
Visiting Officer Floor Space	---	1,114	---
Visiting Airmen Beds	---	5,903	---
Visiting Airmen Floor Space	---	1,357	---
<u>Other Personnel Support</u>			
Weighted Rations Served	771,771	790,796	2.5

Report exhibited considerable increases across the commands, although there was no change in the reported definition. Conversations with OSD indicated that differences in reporting Reserve and Air National Guard units were a major cause of these differences. This implicit change in the data limited their usefulness for analysis in GEBOS-M. Additionally, the ATC totals for FY79 include the Air Force Academy, while the FY78 totals did not. Some of the aggregate workload increases for ATC would have appeared as declines if the Academy were excluded.

And, finally, we expanded our data base for GEBOS-M to include new indicators in the FY79 materials collected to support the greatly expanded capability inherent in that model--as compared to earlier versions of the GEBOS model constructed during our pioneering basic applied research.

Nevertheless, several valid aggregate workload comparisons can be made using the comparative data in the tables, particularly for SAC (Table 2.14) and TAC (Table 2.15). There were declines in many important workload indicators, including base population, accounting and finance transactional data, weighted rations served, and dormitory space. The usefulness of such aggregate workload comparisons can be enhanced by regular reporting and analysis. Previous analyses performed by GRC for FY78 indicated increased workload capability, despite unchanged or slightly declining manpower resources.¹ For FY79, workload capabilities have declined in several areas. Regular analyses of aggregate indicators in the future will indicate whether workload declines are due to short-term or seasonal data variability, or are caused by the impact of manpower or materiel resource reductions. Periodic analyses of manpower and workload data--given the proper mathematical construct and appropriate embellishment/refinement of existing GEBOS-M model capabilities--should allow concise determination as to whether productivity improvements are offsetting manpower and other resource reductions, or whether those manpower and other resource reductions are outstripping productivity enhancement actions.

¹Schmitz et al., Development of a Generalized Explanatory Base Operating Support (GEBOS) Model, January 1980, pp. H20-H23.

SECTION 3
ANALYSIS OF SUPPORT MANPOWER AND WORKLOAD

Statistical relationships between support manpower and workload are a fundamental part of the GEBOS-M model. Equations involving BOS and RPMA functional categories and primary workload indicators serve as the key manpower production constraints in the linear programming module. Additional workload interrelationships, such as between base population and military population, provide supplemental constraints on workload levels. Secondary relationships between descriptive indicators and primary workload indicators or support manpower are also an important part of the GEBOS-M model.

This section documents the development of model relationships correlating support manpower and workload, and correlating workload interrelationships as well. The correlation analyses identifying candidate workload indicators, development of the primary manpower/workload equations, the investigation of workload interrelationships, and the derivation of additional descriptive relationships used in the model are discussed below.

3.1 CORRELATION ANALYSIS

Correlations were run between BOS/RPMA functional manpower and potential workload indicators. This technique aided in the identification of those workload indicators that are most useful for describing and explaining BOS/RPMA manpower/workload relationships.

Functional category manpower includes the sum of four types of functional manpower:

- Officers
- Airmen
- Civilians
- Contract manyear equivalents (CMYEs)

The sum of these four manpower types is the total manpower resource for the function. It should be noted that CMYE resources are likely to be underreported due to the absence of a CMYE reporting requirement on service contracts under \$100,000. However, CMYE underreporting would have a noticeable impact only in selected functions, such as Other Personnel Support, Maintenance of Installation Equipment, and Other Engineering Support. In any case, aggregate underreporting of BOS and RPMA contract services manpower probably would not exceed 2%, with a commensurately minimal effect upon model output--and then only where selected functions are a part of the model's internal computation processes.

Tables 3.1, 3.2, and 3.3 summarize the correlation analyses for the three RPMA functional categories.

- For Maintenance and Repair of Real Property (Table 3.1), military family housing floor space and base total floor space provide highly significant correlations for ATC and SAC. No strong relationships (correlations greater than .6) were exhibited for TAC.
- For Utilities (Table 3.2), ATC had no strong correlations, while base total floor space was the highest correlated indicator for both SAC and TAC--and TAC had strong correlations on most other indicators.
- For Other Engineering Support (Table 3.3), only SAC had strong correlations (with base population and base total floor space).

The manpower/workload correlations for the seven BOS functional categories are provided in Tables 3.4 through 3.10.

- For Administration (Table 3.4), ATC, SAC, and TAC had a number of highly correlated workload indicators, although the correlations were not as strong for TAC.
- For Retail Supply Operations (Table 3.5), aviation fuel consumption, supply transactions, and supply item records provided the highest correlations.

TABLE 3.1
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 30 -
MAINTENANCE AND REPAIR OF REAL PROPERTY (V3)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V19	Military Family Housing Units	.620	.632	.163
V20	Military Family Housing Floor Space	.657	.549	.149
V21	Base Total Floor Space	-.252	.809	.361
V22	Base Total Buildings	-.290	.735	.281
V48	School Facility Buildings	-.234	---	---
V49	School Building Area - Sq. Ft.	.537	---	---
V59	Total Land Area	.261	.294	-.061
V60	Total Building Area	.264	.767	.365
V88	Commercial Service Transactions	-.183	.346	.475
V89	Materiel Transaction Workload	-.323	.369	.514
C1	Total Base Population (excludes CMYEs)	-.279	.492	.437
C2	Total Base Population	-.279	.588	.478
C3	Total Military Population	-.488	.418	.400
	5% significance level	.497	.388	.468

TABLE 3.2
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 32 -
OPERATION OF UTILITIES (V4)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V21	Base Total Floor Space	-.281	.687	.833
V22	Base Total Buildings	-.398	.511	.736
V23	Heating Capacity (in BTUs)	-.403	.244	.392
V26	Air Conditioning Capacity	-.122	.563	.043
V27	Electricity Power Capacity	-.217	.342	.620
V28	Drinking Water Capacity	.402	.359	-.037
V54	Electricity Consumption MWHR	.370	.473	.768
V60	Total Building Area	.497	.662	.720
V81	Natural Gas Consumption	.238	.284	.072
V82	Propane Gas Consumption	.225	-.079	.461
V83	Total Energy Consumption	.492	.439	.749
V84	Total Energy Cost	.458	.401	.660
C1	Total Base Population (excludes CMYEs)	-.080	.381	.779
C2	Total Base Population	-.082	.432	.779
C3	Total Military Population	-.373	.301	.771
	5% significance level	.497	.388	.468

TABLE 3.3
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 33 -
OTHER ENGINEERING SUPPORT (V5)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V19	Military Family Housing Units	.460	.233	-.094
V20	Military Family Housing Floor Space	.605	.443	.311
V21	Base Total Floor Space	.400	.709	.343
V22	Base Total Buildings	.452	.228	-.024
V48	School Facility Buildings	.150	---	---
V49	School Building Area - Sq. Ft.	.274	.104	-.090
V59	Total Land Area	-.006	-.057	-.050
V60	Total Building Area	.401	.719	.074
V63	End FY 79 Total Population	.187	.785	.360
V66	End FY 79 Population Supported	.156	.623	.212
V88	Commercial Service Transactions	.377	.334	.226
V89	Materiel Transaction Workload	.330	.529	.039
C1	Total Base Population (excludes CMYEs)	.423	.737	.423
C2	Total Base Population	.332	.741	.392
C3	Total Military Population	.266	.716	.430
	5% significance level	.497	.388	.468

TABLE 3.4

CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 36 - ADMINISTRATION (V6)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V29	Travel Transactions	.477	.838	.445
V61	Total BOS Budget	.689	.777	.684
V63	End FY 79 Total Population	.753	.941	.586
V66	End FY 79 Population Supported	.616	.533	.230
V77	Average Daily Load of Students	.575	---	---
V78	Total Annual Output of Students	.564	---	---
V85	Transactions Audited	.785	.746	.567
V86	Total Air Force Members	.749	.931	.634
V87	Civilian Pay Accounts	.788	.488	.613
V88	Commercial Service Transactions	.741	.576	.550
V89	Materiel Transaction Workload	.885	.680	.666
C1	Total Base Population (excludes CMYEs)	.878	.945	.556
C2	Total Base Population	.876	.952	.578
C3	Total Military Population	.851	.891	.502
	5% significance level	.497	.388	.468

TABLE 3.5
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 37 -
RETAIL SUPPLY OPERATIONS (V7)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V33	Aviation Fuel	.746	.613	.647
V34	Supply Transactions	.883	.706	.925
V37	Equipment Transactions	.094	.323	.697
V38	Supply Item Records	.792	.765	.960
V39	Equipment Item Records	.267	.657	.906
V63	End FY 79 Total Population	-.314	.662	.852
V66	End FY 79 Population Supported	-.389	.423	.211
V83	Total Energy Consumption	-.450	.149	.812
V89	Materiel Transaction Workload	.136	.424	.722
C1	Total Base Population (excludes CMYEs)	-.014	.590	.902
C2	Total Base Population	-.071	.588	.910
C3	Total Military Population	.059	.543	.880
C4	Total Ground Fuel Consumption	-.404	.139	.460
	5% significance level	.497	.388	.468

TABLE 3.6
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 38 -
MAINTENANCE OF INSTALLATION EQUIPMENT (V8)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V32	Gasoline	-.039	.186	.090
V34	Supply Transactions	.522	.097	.779
V37	Equipment Transactions	.614	.573	.657
V38	Supply Item Records	.715	.416	.876
V39	Equipment Item Records	.511	.557	.820
V40	Vehicles On Hand	.309	-.157	.729
V41	Vehicles Authorized	.148	.871	.768
V63	End FY 79 Total Population	.420	.228	.705
V66	End FY 79 Population Supported	.225	-.229	.335
V73	Military Vehicles	---	.060	.059
V74	Total Vehicles	---	.893	.874
V75	Vehicle Equivalents	---	.854	.852
V76	Miles Driven	---	.669	.901
C1	Total Base Population (excludes CMYEs)	.704	.357	.725
C2	Total Base Population	.695	.355	.721
C3	Total Military Population	.720	.255	.679
C4	Total Ground Fuel Consumption	.128	.501	.249
	5% significance level	.497	.388	.468

TABLE 3.7
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 39 -
OTHER BASE SERVICES (V9)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V29	Travel Transactions	.551	.694	.790
V32	Gasoline	---	-.055	.399
V40	Vehicles On Hand	.080	-.042	.386
V41	Vehicles Authorized	.180	.261	.379
V42	Visiting Airmen Beds	.882	.079	.407
V43	Visiting Airmen Floor Space	.897	.017	.381
V44	Visiting Officer Beds	.307	.326	.452
V45	Visiting Officer Floor Space	.410	.256	.380
V70	Dormitory Beds	.739	.406	.434
V71	Dormitory Floor Space	.767	.320	.501
V72	Weighted Rations	.716	.472	.140
V74	Total Vehicles	---	.316	.471
V75	Vehicle Equivalents	---	.273	.460
V76	Miles Driven	---	.089	.557
V77	Average Daily Load of Students	.758	.145	-.051
V63	End FY 79 Total Population	.879	.930	.810
C1	Total Base Population (excludes CMYEs)	.836	.912	.855
C2	Total Base Population	.866	.916	.846
C3	Total Military Population	.840	.904	.818
	5% significance level	.497	.388	.468

TABLE 3.8
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 40 -
BACHELOR HOUSING OPERATIONS AND FURNISHINGS (V10)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V29	Travel Transactions	.667	.249	.577
V42	Visiting Airmen Beds	.700	.302	.679
V43	Visiting Airmen Floor Space	.689	.333	.642
V44	Visiting Officer Beds	.239	.443	.297
V45	Visiting Officer Floor Space	.355	.405	.206
V70	Dormitory Beds	.519	.018	.627
V71	Dormitory Floor Space	.540	.179	.654
V72	Weighted Rations	.528	.108	.510
C3	Total Military Population	.903	.048	.725
	5% significance level	.497	.388	.468

TABLE 3.9
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 41 -
MORALE, WELFARE, AND RECREATION (V11)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
V77	Average Daily Load of Students	.835	.039	.311
C1	Total Base Population (excludes CMYEs)	.805	.897	.723
C2	Total Base Population	.804	.898	.740
C3	Total Military Population	.825	.892	.701
	5% significance level	.497	.388	.468

TABLE 3.10
CORRELATION ANALYSIS: DOD FUNCTIONAL CATEGORY 42 -
OTHER PERSONNEL SUPPORT (V12)

Computer Name	Workload Indicator	Correlations		
		ATC	SAC	TAC
C1	Total Base Population (excludes CMYEs)	.686	.317	.695
C2	Total Base Population	.749	.317	.720
C3	Total Military Population	.749	.387	.706
V72	Weighted Rations	.985	.661	.751
V42	Visiting Airmen Beds	.765	.015	.686
V43	Visiting Airmen Floor Space	.848	-.030	.615
V62	End FY 79 Authorized Full-Time Assigned Personnel	.736	.283	.784
V63	End FY 79 Total Population	.928	.154	.785
V66	End FY 79 Population Supported	.873	-.043	.164
V92	Missile Bases	---	.720	---
	5% significance level	.497	.388	.468

- Total vehicles, vehicle equivalents, and miles driven provided the highest correlations for Maintenance of Installation Equipment (Table 3.6) in SAC and TAC.
- Base population proved to be highly correlated for Other Base Services (Table 3.7) in all three commands.
- Military population was highly correlated with Bachelor Housing manpower (Table 3.8) for ATC and TAC, but no single workload indicator was particularly strong for SAC.
- Military population was highly correlated for all three commands for Morale, Welfare, and Recreation (Table 3.9).
- Weighted rations served provided the highest consistent correlations across commands for Other Personnel Support (Table 3.10).

The strongly correlated workload indicators served as the initial basis for the derivation of the GEBOS-M manpower/workload equations. Those specific command/function combinations that did not exhibit strong correlations were candidates for regression analyses covering specific bases or groups of bases. Derivation of the manpower/workload equations applicable in those cases is described in the following subsection.

3.2 DERIVATION OF GEBOS-M MANPOWER/WORKLOAD EQUATIONS

Derivation of BOS/RPMA manpower/workload equations was a key activity in model development. These relationships are central to the GEBOS-M computational process. The equations are designed to compute workload quantities which can be handled by a given quantity of BOS/RPMA manpower or, conversely, how much BOS/RPMA manpower would be required to execute specific BOS workload levels.

The development of the model manpower/workload equations required performance of stepwise linear regressions for each of the 10 DOD functional categories for each of the three test commands. Quantitative workload indicators were identified and tested to search out those conforming to the following standards:

- Workload indicators highly correlated with functional manpower.
- Workload indicators believed to have a strong logical relationship with the work performed in a functional category.
- Workload indicators shown to be significant functional manpower explainers in previous analyses.
- Workload indicators identified by AFMEA in previous functional estimating equations.

In addition to workload indicators, selected qualitative variables were evaluated. These variables account for manpower additions or exclusions for a specific function associated with a specific base or group of bases. The latter include:

- Randolph and Lackland AFBs in ATC (for functions handled by the San Antonio Real Property Maintenance Agency).
- Missile bases in SAC.
- Other individual bases with specific functional additives or exclusions identified by AFMEA.

Selection of workload indicators was based upon multivariate regression analysis. GRC used overall explanatory power [in terms of highest proportion of variance (R^2) explained by the independent variables and lowest coefficient of variations] as the principal criterion for selection of variables, along with a logical relationship to functional activities. Where several alternative manpower/workload specifications were identified as reliable, the same workload indicators were applied to the three test commands, enhancing the comparability of results across commands.

Table 3.11 lists the manpower/workload equations derived for the RPMA functional categories in SAC, TAC, and ATC. Tables 3.12 through 3.14 identify the manpower/workload equations derived for BOS functional categories in the three test commands. For Table 3.11, RPMA program

TABLE 3.11
MANPOWER/WORKLOAD EQUATIONS FOR RPMA PROGRAM ELEMENTS

<u>SAC Program Element Code 11894</u>							
<u>Explanatory Variables/GEBOs-M Codes</u>							
<u>DOD Functional Category/Code</u>	<u>Military</u>				<u>Additives/ Exclusions</u>	<u>Constant</u>	<u>R²</u>
	<u>Base Population (C2)</u>	<u>Housing Floor Space (V20)</u>	<u>Non-Housing Floor Space (C5)</u>	<u>Missile Bases (V92)</u>			
Maintenance and Repair of Real Property/30	.007854	.01870	.04210	86.26	253.40	99.85	.968
Operation of Utilities/32			.01325		38.31	34.75	.656
Other Engineering Support/33	.007562				158.91	62.49	.820
<u>TAC Program Element Code 27594</u>							
<u>Explanatory Variables/GEBOs-M Codes</u>							
<u>DOD Functional Category/Code</u>	<u>Military</u>				<u>Additives/ Exclusions</u>	<u>Constant</u>	<u>R²</u>
	<u>Base Population (C2)</u>	<u>Housing Floor Space (V20)</u>	<u>Non-Housing Floor Space (C5)</u>	<u>Non-Housing Floor Space (C5)</u>			
Maintenance and Repair of Real Property/30	.01584	.01758			424.80	178.92	.717
Operation of Utilities/32				.02071		16.86	.631
Other Engineering Support/33	.002717	.002903			94.41	91.38	.696
<u>ATC and USAF Academy Program Element Code 85794</u>							
<u>Explanatory Variables/GEBOs-M Codes</u>							
<u>DOD Functional Category/Code</u>	<u>Military</u>				<u>Additives/ Exclusions</u>	<u>Constant</u>	<u>R²</u>
	<u>Base Population (C2)</u>	<u>Housing Floor Space (V20)</u>	<u>Non-Housing Floor Space (C5)</u>	<u>Randolph/ Lackland (D13)</u>			
Maintenance and Repair of Real Property/30		.1166		-243.76		122.43	.891
Operation of Utilities/32	.003836	.01863			-65.54	20.69	.608
Other Engineering Support/33			.003393		72.38	91.11	.509

TABLE 3.12
MANPOWER/WORKLOAD EQUATIONS FOR SAC BOS PROGRAM ELEMENT CODE 11896

DOW Functional Category/Code	Explanatory Variables/GEOS-M Codes										Additives/ Exclusions	Constant	R ²
	Base Population (C2)	Travel Transactions (V29)	Total Item Records (C7)	Aviation Fuel Consumption (V33)	Military Vehicles (V73)	Military Miles Driven (V76)	Airmen Beds (V42)	Military Population (C3)	Weighted Rations Served (V72)	Missile Bases (V92)			
Administra- tion/36	.03667	.008306										55.89	.927
Retail Supply Operations/37			.01520	.01188								162.68	.676
Maintenance of Installation Equipment/38					.3734	.01194					107.12	37.74	.909
Other Base Services/39	.02713											148.96	.757
Bachelor Housing Operations/40							.002548			-2.36	12.63	12.44	.567
Morale, Welfare, and Recreation/41								.003061				21.55	.796
Other Personnel Support/42	.002282								.003475	47.68		14.55	.798

TABLE 3.13

MANPOWER/WORKLOAD EQUATIONS FOR TAC BOS PROGRAM ELEMENT CODE 27596

DOD Functional Category/Code	Explanatory Variables/CEBOS-M Codes									Additives/ Exclusions	Constant	R ²
	Base Population (C2)	Travel Transactions (V29)	Total Item Records (C7)	Fuel Aviation Consumption (V33)	Miles Driven (V76)	Military Vehicles (V73)	Airmen Beds (V42)	Military Population (C3)	Weighted Rations Served (V72)			
Administration/36	.01317									-119.47	198.03	.728
Administration/36 *		.005362*								-120.62	247.17	.595
Retail Supply Operations/37			.02508								117.91	.931
Retail Supply Operations/37 *				.02721*							245.60	.468
Maintenance of Installation Equipment/38					.01544	.1149					25.05	.648
Other Base Services/39	.03481									11.21	59.53	.740
Bachelor Housing Operations/40							.02013			13.46	10.00	.719
Morale, Welfare, and Recreation/41								.001617		-4.47	28.39	.542
Other Personnel Support/42	.009138								.003516		-12.24	.747

* Supplemental explanatory coefficients for the DOD functional categories indicated. The Base Population coefficient for the Administration functional category and the Total Item Records coefficient for the Retail Supply Operations functional category, shown on this table, are the preferred explanatory variables in their respective functional categories. At the discretion of the CEBOS-M model user, however, the supplemental rather than the preferred explanatory variable may be selected when its application results in a greater manpower resource impact.

TABLE 3.14

MANPOWER/WORKLOAD EQUATIONS FOR ATC/USAF ACADEMY BOS PROGRAM ELEMENT CODES 85796/85896*

BOD Functional Category/Code	Explanatory Variables/GEROS-M Codes										Additives/ Exclusions	Constant	R ²
	Base Popu- lation (C2)	Travel Trans. (V29)	Total Item Records (C7)	Aviation Fuel Con. (V33)	Military Vehicles (V73)	Miles Driven (V76)	Airmen Beds (V42)	Students Authorized (V91)	Military Popu- lation (C3)	Weighted Rations Served (V72)			
Administration/36	.02738	.01537									81.12	105.35	.916
Retail Supply Operations/37			.01249	.01449								142.52	.745
Maintenance of Installation Equipment/38					.2042	.02306					-92.84	26.18	.502
Other Base Services/39	.04154										42.70	42.58	.973
Bachelor Housing Operations/40							.003704		.003789			3.84	.854
Morale, Welfare, and Recreation/41								.002494	.003096		-21.70	23.41	.912
Other Personnel Support/42										.002619		42.21	.970

* USAF Academy data were included with ATC on an experimental basis at the request of AF/MPNZ. Purpose was to isolate common factors in view of common training mission. As a practical matter, essentially the same BOS/RPMA manpower/workload variables apply to the Academy's single station as apply to ATC bases generally.

elements and DOD functional categories are listed on the left, while the significant explanatory workload indicators are listed across the center of the page. Tables 3.12 through 3.14 are similarly structured for BOS program elements, with each command shown on a separate table. Under the heading "Explanatory Variables," the coefficients listed in each functional workload column indicate the appropriate change in functional manpower that would be required per unit of workload. For example, using Table 3.11, an increase in base population of 1000 for SAC would increase RPMA functional manpower in the Maintenance and Repair of Real Property category by approximately eight authorizations ($.007854 \times 1000 = 7.854$). Using Table 3.12, it can be seen that the same population change would increase BOS functional manpower in the Administration category by approximately 37 authorizations ($.03667 \times 1000 = 36.67$). On each table, the coefficients under the "Additives/Exclusions" columns are, effectively, adjustment factors which recognize unique requirements at a selected base or bases identified within the MAJCOMs concerned. On each table, the coefficients under the "constant" columns represent the fixed operating costs of the aggregation of bases within the MAJCOMs concerned before any consideration is given to workload levels by function, or to the unique requirements at selected bases as just discussed. Given appropriate functional workload and base identification data, application of the coefficients shown on Tables 3.11 through 3.14 will provide an estimate of total RPMA/BOS manpower requirements for each MAJCOM concerned, by functional category.

On each of Tables 3.12 through 3.14, there are listed under the final columns headed " R^2 " statistical measures of the explanatory power of the several coefficients shown for each DOD functional category. In each instance, the explanatory power exceeds the 99% statistical confidence level. Table 3.15 provides estimates of the coefficients of variation of the functional equations. The standard error as a percent of mean (coefficient of variation) is usually below 20%, and exceeds 30% in only two cases. Both of these cases of high variability occur in ATC functions where large amounts of contract manpower are present. It may be that inadequate reporting of CMYEs is the cause of the high variability

TABLE 3.15
STANDARD ERRORS AS A PROPORTION OF MEAN (%)

<u>Function/Function Code</u>	<u>SAC</u>	<u>TAC</u>	<u>ATC</u>
Maintenance and Repair of Real Property/30	8.9	25.1	15.4
Operation of Utilities for All Real Property/32	18.7	18.3	27.2
Other Engineering Support/33	15.9	16.7	36.5
Administration/36	10.8	13.0	15.5
Retail Supply Operations/37	9.7	5.2	12.7
Maintenance of Installation Equipment/38	11.9	14.7	43.1
Other Base Services/39	11.8	16.5	12.6
Bachelor Housing Operations and Furnishing/40	17.6	22.2	19.0
Morale, Welfare, and Recreation/41	8.8	8.0	14.7
Other Personnel Support/42	17.3	19.9	22.9

for these functions (CMYE reporting deficiencies are also referenced in preceding sections of this report).

Tables 3.16 through 3.19 provide the aggregate workload levels used for the three commands. Table 3.16 illustrates the workload levels for the three RPMA program elements, and Tables 3.17 through 3.19 provide the respective BOS workloads for SAC, TAC, and ATC.

Table 3.20 identifies the bases at which qualitative variables were used in the development of the manpower/workload equations. Qualitative variables representing these bases were used as additive or exclusion factors for the functions and commands identified.

One note should be made about the base population figures used in derivation of manpower/workload equations. AFMEA uses "net base" population figures in deriving manpower/workload equations. That is, functional category manpower is subtracted from total base population in developing each functional equation. This technique is seen as a means of avoiding the support-on-support issue by removing a function's own contribution to base population. In GEBOS-M that technique is not used; total base population is solved for simultaneously with BOS functional manpower. The GEBOS-M technique allows for explicit computation of support-on-support relationships.

3.3 WORKLOAD INTERRELATIONSHIPS

Selected workloads were found to be interrelated. Table 3.21 identifies the support workload interrelationships used in GEBOS-M. For example, SAC travel transactions are determined by base population (GEBOS-M workload indicator C2). The 1.0333 coefficient applied to base population (C2) best estimates the travel transaction workload for any given base population figure. Thus, for example, an increase in base population of 1000 would produce a raw increase of $1.0333 \times 1000 = 1033.3$ travel transactions. Workload additive or exclusion factors for unique bases are identified by the terms "ADD" or "EXCL" (all cases on Table 3.21 were exclusions). Base-level constant terms are provided, where

TABLE 3.16
WORKLOAD FOR RPMA PROGRAM ELEMENTS

DOD Category/Function Code	Explanatory Variables						Additives/ Exclusions	Bases
	Military		Non-		Missile Bases (V92)	Randolph/ Lackland (D13)		
	Housing	Housing	Floor	Space				
	Floor Space (V20)	Floor Space (C5)						
			SAC PEC 11894					
Maintenance and Repair of Real Property/30	132,349	52,941	71,110	7			1	26
Operation of Utilities/32			71,110				1	26
Other Engineering Support/33	132,349						1	26
			TAC PEC 27594					
Maintenance and Repair of Real Property/30	100,436	27,019					1	17
Operation of Utilities/32			39,628					17
Other Engineering Support/33	100,436	27,019					1	17
			ATC and Air Force Academy PEC 85794					
Maintenance and Repair of Real Property/30		19,588				2		15
Operation of Utilities/32	75,772	19,588					1	13
Other Engineering Support/33			52,008				2	16

TABLE 3.17
WORKLOAD FOR SAC BOS PROGRAM ELEMENT CODE 11896

DOD Category/ Function Code	Explanatory Variables										Additives/ Exclusions	Bases
	Base Popu- lation (C2)	Travel Trans- actions (V29)	Total Item Records (C7)	Aviation Fuel Con- sumption (V33)	Military Vehicles (V73)	Miles Driven (V76)	Visiting Airmen Beds (V42)	Military Popu- lation (C3)	Weighted Rations Served (V72)	Missile Bases (V92)		
Administration/36	132,349	106,177										26
Retail Supply Operations/37			174,723	73,087								26
Maintenance of Installation Equipment/38					145	91,220					1	26
Other Base Services/39	132,349											26
Bachelor Housing Operations/40							1,751			7	2	26
Morale, Welfare, and Recreation/41								109,548				26
Other Personnel Support/42	132,349								424,452	7		26

TABLE 3.18
WORKLOAD FOR TAC BOS PROGRAM ELEMENT CODE 27596

DOD Category/ Function Code	Explanatory Variables								Additives/ Exclusions	Bases	
	Base Population (C2)	Travel Trans- actions (V29)	Total Item Records (C7)	Aviation Fuel Con- sumption (V33)	Miles Driven (V76)	Military Vehicles (V73)	Visiting Airmen Beds (V42)	Military Population (C3)			Weighted Rations Served (V72)
Administration/36	100,436	82,092							2	18	
Retail Supply Operations/37			151,018	54,733						18	
Maintenance of Installation Equipment/38					37,167	497				18	
Other Base Services/39	100,436								1	18	
Bachelor Housing Operations/40							1,663		1	16	
Morale, Welfare, and Recreation/41								83,760	1	18	
Other Personnel Support/42	100,436									334,275	18

TABLE 3.19

WORKLOAD FOR ATC/USAF ACADEMY BOS PROGRAM ELEMENT CODES 85796/85896

DOD Category/ Function Code	Explanatory Variables										Additives/ Exclusions	Bases
	Base Popu- lation (C2)	Travel Trans- actions (V29)	Total Item Records (C7)	Aviation Fuel Con- sumption (V33)	Military Vehicles (V73)	Miles Driven (V76)	Visiting Airmen Beds (V42)	Students Author- ized (V91)	Military Popu- lation (C3)	Weighted Rations Served (V72)		
Administration/36	75,772	77,086									2	16
Retail Supply Operations/37			73,848	19,513								14
Maintenance of Installation Equipment/38					156	22,373					3	15
Other Base Services/39	75,772										2	16
Bachelor Housing Operations/40							5,903		45,143			13
Morale, Welfare, and Recreation/41								37,023	45,143		1	15
Other Personnel Support/42										790,796		15

TABLE 3.20
BASES WITH ADDITIVE OR EXCLUSION FACTORS FOR
SPECIFIC MANPOWER/WORKLOAD EQUATIONS

<u>DOD Functional Code/Category</u>	<u>Command</u>		
	<u>ATC</u>	<u>SAC</u>	<u>TAC</u>
FC30: Maintenance and Repair of Real Property		Vandenberg	Luke
FC32: Operation of Utilities for All Real Property	AF Academy	Beale	
FC33: Other Engineering Support		Vandenberg	Langley
FC36: Administration			Mountain Home
FC37: Retail Supply Operations	Randolph, Lackland		
FC38: Maintenance of Installa- tion Equipment		Griffiss	
FC39: Other Base Services	Vance, Lackland, San Antonio		Shaw
FC40: Bachelor Housing Operations and Furnishing	Chanute, Randolph	Fairchild, Anderson	Howard
FC41: Morale, Welfare, and Recreation	Vance		Seymour Johnson
FC42: Other Personnel Support			

TABLE 3.21
SUPPORT WORKLOAD INTERRELATIONSHIPS

<u>SAC</u>		<u>R²</u>
Travel Transactions (V29)	= 1.0333(C2) - 1176.12	.599
Miles Driven (V76)	= 0.1883(C2) + 4122.5(V92) - 2510.8(EXCL)	.804
Military Population (C3).	= 0.8277(C2)	.892
Airmen Population (V16)	= 0.8330(C3)	.981
Weighted Rations Served (V72)	= 3.1065(V16) - 6845.0(EXCL) + 5684.5	.598
Visiting Airmen Beds (V42)	= 0.00469(V16) - 120.4(EXCL) + 101.8	.380
<u>TAC</u>		
Military Population (C3)	= 0.8340(C2)	.977
Weighted Rations Served (V72)	= 3.4134(V16) - 2517.6(EXCL) + 5027.4	.707
Visiting Airmen Beds (V42)	= 0.0234(V16) - 109.9(EXCL) + 35.2	.371
Airmen Population (V16)	= 0.8614(C3)	.989
<u>ATC</u>		
Travel Transactions (V29)	= 1.0468(C2) - 171.7	.378
Military Population (C3)	= 0.5774(C2)	.867
Weighted Rations Served (V72)	= 22.1644(V91) - 1862.3	.904
Miles Driven (V76)	= 0.2160(C2) + 375.2	.474
Visiting Airmen Beds (V42)	= 0.2326(V16) - 634.7(EXCL) + 158.0	.856
Airmen Population (V16)	= 0.7642(C3)	.961

appropriate, to bring total workload levels into statistical agreement. R^2 statistics presented in the final column of Table 3.21 demonstrate statistical significance at the 99% confidence level. These support workload interrelationships applied in the GEBOS-M equations help to assure balanced changes in related workloads when exercising the model.

3.4 ADDITIONAL DESCRIPTIVE WORKLOAD INDICATORS IN GEBOS-M

Other workload indicators, while not used in the actual linear programming computational procedure, are computed by GEBOS-M for descriptive purposes. For example, these include:

- Total energy consumption
- BOS budget
- Total transactions processed

These additional indicators were not the primary manpower-driving factors used in the model, but can provide useful planning information. They are computed from the model based upon regressions relating them to either functional manpower or other primary workload measures. Tables 3.22 through 3.24 list the regressions used for the additional descriptive indicators.

TABLE 3.22

SAC - REGRESSIONS FOR SECONDARY WORKLOAD INDICATORS

<u>Dependent Variable</u>	<u>Coefficient</u>	<u>Independent Variable</u>	<u>Constant</u>	<u>R²</u>
Military Family Housing Units	0.2674	Military Housing Floor Space	-14,350.123	.335
Total Energy Consumption	0.2054	Base Total Floor Space	-2,204.075	.681
Total Electricity Consumption	16.014	Base Total Floor Space	-198,755.8	.561
Total BOS Budget	45.1020	Administration	-319,739.608	.610
Transactions Audited	66.8061	Administration	34,625.466	.557
Total Air Force Members Serviced	0.9449	Total Military Population	16,465.095	.962
Civilian Pay Accounts	1.1244	Total Base Civilians	-4,507.444	.941
Commercial Service Transactions	0.4370	Travel Transactions	35,002.651	.685
Material Transaction Workload	0.1027	Travel Transactions	13,063.622	.588
Total Transactions	226.5354	Supply	-194,077.956	.408
Vehicle Equivalents	9.9795	Installation Maintenance	12,120.756	.728
Total Vehicles	5.0313	Installation Maintenance	4,814.138	.782

TABLE 3.23

TAC - REGRESSIONS FOR SECONDARY WORKLOAD INDICATORS

<u>Dependent Variable</u>	<u>Coefficient</u>	<u>Independent Variable</u>	<u>Constant</u>	<u>R²</u>
Military Family Housing Units	0.3588	Military Housing Floor Space	862.583	.536
Total Energy Consumption	0.1590	Base Total Floor Space	-2,471.873	.775
Total Electricity Consumption	25.714	Non-Housing Floor Space	19,791.5	.662
Total BOS Budget	116.5523	Administration	-541,149.090	.502
Transactions Audited	3.2060	Total Base Population Including CMYEs	79,394.184	.778
Total Air Force Members Serviced	0.9183	Total Base Population Including CMYEs	1,363.621	.973
Civilian Pay Accounts	0.1596	Total Base Population Including CMYEs	-787.586	.556
Commercial Services Transactions	0.3398	Total Base Population Including CMYEs	36,962.847	.466
Materiel Transaction Workload	0.1712	Total Base Population Including CMYEs	1,439.357	.586
Total Transactions	422.4155	Supply	-914,600.605	.868
Vehicle Equivalents	13.8092	Installation Maintenance	4,471.446	.438
Total Vehicles	7.4204	Installation Maintenance	1,266.127	.524

TABLE 3.24

ATC - REGRESSIONS FOR SECONDARY WORKLOAD INDICATORS

<u>Dependent Variable</u>	<u>Coefficient</u>	<u>Independent Variable</u>	<u>Constant</u>	<u>R²</u>
Military Family Housing Units	0.3269	Military Housing Floor Space	1,507.683	.555
Total Energy Consumption	0.1750	Base Total Floor Space	-617.3	.900
Total Electricity Consumption	12.6261	Non-Housing Floor Space	283,449.791	.748
Total BOS Budget	65.2518	Administration	-300,315.590	.594
Transactions Audited	70.7031	Administration	14,954.076	.676
Total Air Force Members Serviced	1.3735	Total Base Population Including CMYEs	-29,889.842	.814
Civilian Pay Accounts	7.9113	Administration	-14,080.4	.661
Commercial Service Transactions	13.9327	Administration	-5,233.490	.602
Materiel Transaction Workload	4.1520	Administration	-5,443.472	.839
Supply*	.003199	Total Transactions	64.433	.797
Total Vehicles	.1853	Miles Driven	34.301	.869
Dormitory Beds	1.5061	Total Students Authorized	2,871.660	.974
Visiting Airmen Beds	0.1746	Non-Housing Floor Space	-3,177.597	.611
Visiting Airmen Floor Space	0.2095	Visiting Airmen Beds	120.322	.918

* Stated in terms of total transactions for display purposes.

SECTION 4
ANALYSIS OF MISSION CAPABILITIES AND SUPPORT WORKLOAD

Investigation of mission activities began with a review of primary mission manpower and weapon systems for the three test commands. Mission elements and manpower from the Program Document (PD): Bases, Units, and Priorities were analyzed to quantify principal command weapons system structures. Major programmable peacetime mission workload indicator data--such as flying hours by aircraft mission/design/series (M/D/S)--were concurrently collected. Table 4.1 lists the principal relationships identified between weapon systems and mission workload indicators.

Once principal mission workload activities had been identified and quantified, their relationships to support workload indicators were investigated. Both logical and statistical relationships were used in the identification of valid relationships.

This section discusses mission capabilities, how they are used in the GEBOS-M model, principal mission capability data employed, and how the key relationships between mission capabilities and support workload indicators were developed.

4.1 REVIEW OF MISSION CAPABILITIES

While a variety of data sources and items were initially reviewed, the following mission data were identified for GEBOS-M input because of their ready availability, regularized reporting procedures/formats, and--most importantly--their programmable nature and key role in the planning process:

- Mission manpower
- Aircraft
- Missiles
- Flying hours
- Sorties
- Training workload

TABLE 4.1
WEAPON SYSTEMS AND CAPABILITY INDICATORS

<u>Program Element</u>	<u>Command</u>	<u>Weapon System</u>	<u>Capability Indicators</u>
11113	SAC	B-52	Aircraft, Flying Hours, Sorties, Squadrons
11115	SAC	FB-111	Aircraft, Flying Hours, Sorties, Squadrons
11118	SAC	SRAM	B-52G/H Aircraft, Squadrons
11142	SAC	KC-135	Aircraft, Flying Hours, Sorties, Squadrons
11212	SAC	Titan	Missiles, Squadrons
11213	SAC	Minuteman	Missiles, Squadrons
21120	TAC	Airborne Command Post	Aircraft, Flying Hours, Sorties, Squadrons
27121	TAC	A-7	Aircraft, Flying Hours, Sorties, Squadrons
27127	TAC	F-105	Aircraft, Flying Hours, Sorties, Squadrons
27128/ 27597	TAC	F-4	Aircraft, Flying Hours, Sorties, Squadrons
27129/ 27597	TAC	F-111	Aircraft, Flying Hours, Sorties, Squadrons
27130/ 27597	TAC	F-15	Aircraft, Flying Hours, Sorties, Squadrons
27131/ 27597	TAC	A-10	Aircraft, Flying Hours, Sorties, Squadrons
27213/ 27597	TAC	RF-4	Aircraft, Flying Hours, Sorties, Squadrons
27218	TAC	Aggressor Squadron (F-5)	Aircraft, Flying Hours, Sorties, Squadrons
27412	TAC	O-2	Aircraft, Flying Hours, Sorties, Squadrons
32015	SAC	National Emergency Airborne Command Post (E-4)	Aircraft, Flying Hours, Sorties, Squadrons
81714/ 84711	ATC	Personnel Processing and Recruit Training	Recruit Training Workload
84721	ATC	Service Academy	Cadet Training Workload
84731	ATC	General Skill Training	Technician Training Workload
84733/ 84734	ATC	General Intelligence and Crypto Skill Training	Crypto/Intelligence Training Workload
84741/ 84743	ATC	Undergraduate Pilot Training	Aircraft, Flying Hours, Sorties, Squadrons, Pilot Training Workload
84742	ATC	Undergraduate Navigator Training	Aircraft, Flying Hours, Sorties, Squadrons, Navigator Training Workload
84751/ 84752	ATC	Professional Education	Professional Education Training Workload

Tables 4.2 through 4.4 identify mission manpower in SAC, TAC, and ATC for FY79. Mission manpower, for modeling purposes, refers to all manpower not included in the BOS and RPMA program elements. All program elements accounting for over 100 spaces in the commands are identified.

Table 4.5 lists the total aircraft, flying hours, sorties, and missiles by M/D/S for SAC. Table 4.6 provides similar information for TAC on aircraft, flying hours, and sorties. Table 4.7 provides data for ATC on training aircraft, flying hours, sorties, and the training mission student workload.

4.2 DERIVATION OF MISSION/SUPPORT WORKLOAD RELATIONSHIPS

The development of programmable relationships between mission and support workload was a key focus of this research effort. The following logical and programmable relationships were identified:

- Aircraft/mission program element manpower
- Missiles/mission program element manpower
- Student workload/mission program element manpower
- Aircraft/total item records
- Flying hours/aviation fuel consumption
- Flying hours/sorties
- Sorties/miles driven
- Missiles/miles driven

The mission capability measures are listed on the left, with their corresponding workload changes on the right. The one exception is flying hours/sorties, which were both mission capability measures. Sorties generated proved to be a predictor of miles driven for TAC. Specific mission/workload data on the first four items listed is contained in Appendix C, Mission Data and Analysis Program.

Principal relationships between aircraft and missiles and mission program element manpower for SAC are given in Table 4.8. Results were based upon regression analyses, except for Titan squadrons and NEACP,

TABLE 4.2
SAC MISSION MANPOWER* BY PROGRAM ELEMENT CODE
(Manpower Outside of PECs 11894, 11896)

<u>PEC</u>	<u>Definition</u>	<u>Manpower</u>
11113	B-52 Squadrons	18,412
11115	FB-111 Squadrons	2,959
11118	SRAM (AGM-69)	1,491
11142	KC-135 Squadrons	10,395
11212	Titan Squadrons	2,061
11213	Minuteman Squadrons	10,594
11310	WWMCCS ADP-SAC	918
11312	Post Attack CMD and Control System	1,335
11820	Mission Evaluation Activity (Offensive)	395
11830	Operational Headquarters (Offensive)	752
11897	Training (Offensive)	651
11898	Management Headquarters (Strategic Offensive Forces)	3,286
28030	WRM-Ammunition	533
31011	Cryptologic Activities	807
31021	Intelligence Production Activities	1,073
31025	Intelligence Data Handling System	353
31037	Senior Year Operations	407
32015	National Emergency Airborne Command Post-NEACP	352
35157	Advance Location Strike System (ALSS)	147
35160	Defense Meteorological Satellite Program	266
41314	Operational Support Airlift	279
87715	Dental Care Activities	945
87792	Station Hospitals and Medical Clinics	6,026
---	Other SAC	1,122
---	Tenant Manpower**	25,438
Total Mission Manpower		90,997

* Excludes manpower associated with selected systems on which operational data are classified.

** Tenant manpower is effectively treated by the existing GEBOS-M as other-mission manpower; no attempt is currently made to allocate tenant manpower by PE. Extension of GEBOS-M Air Force-wide should include model modifications to address tenant manpower by function.

TABLE 4.3

TAC MISSION MANPOWER BY PROGRAM ELEMENT CODE
(Manpower Outside of PECs 27594, 27596)

<u>PEC</u>	<u>Definition</u>	<u>Manpower</u>
21120	Airborne Command Post (CINCLANT)	332
27121	A-7 Squadrons	1,676
27127	F-105 Squadrons	486
27128	F-4 Squadrons	10,533
27129	F-111 Squadrons	3,809
27130	F-15 Squadrons	3,632
27131	A-10 Squadrons	1,349
27213	RF-4 Squadrons	2,511
27218	Tactical Fighter Training (Aggressor) Squadron	657
27236	Operational Headquarters (TAF)	215
27241	Special Operations Force	1,577
27412	Tactical Air Control System	3,768
27422	Tactical Air Control System Command	572
27428	Tactical Fighter Weapons Center Range	932
27430	Civil Engineer Squadrons (HV Repair)	400
27431	Tactical Air Intelligence System Activities	468
27597	Training-Tactical Air Forces	13,049
27598	Management Headquarters (Tactical Air Forces)	2,424
28015	Combat Developments	694
28031	WRM-Equipment/Secondary Items	360
87711	Care in Regional Defense Facilities	340
87715	Dental Care Activities	664
87792	Station Hospitals and Medical Clinics	3,926
---	Other TAC	2,601
--	Tenant Manpower *	15,929
Total Mission Manpower		72,904

* Tenant manpower is effectively treated by the existing GEBOS-M as other-mission manpower; no attempt is currently made to allocate tenant manpower by PE. Extension of GEBOS-M Air Force-wide should include model modifications to address tenant manpower by function.

TABLE 4.4
ATC* MISSION MANPOWER BY PROGRAM ELEMENT CODE
(Manpower Outside of PECs 85794, 85796)

<u>PEC</u>	<u>Definition</u>	<u>Manpower</u>
35111	Weather Service	211
81714	Personnel Processing Activities	368
84711	Recruit Training Units	839
84721	Service Academy	2,874
84731	General Skill Training	7,427
84733	General Intelligence Skill Training	144
84734	Crypto/SIGINT Related Skill Training	426
84741	Undergraduate Pilot Training	4,847
84742	Undergraduate Navigator/NFO Training	657
84743	Other Flight Training	677
84751	Professional Military Education	429
84752	Other Professional Education	336
84771	Support of Training Establishment	615
85798	Management Headquarters (Training)	1,345
86761	Education/Training (Health Care)	459
87711	Care in Regional Defense Facilities	1,175
87715	Dental Care Activities	581
87792	Station Hospitals and Medical Clinics	2,922
88716	Other Personnel Activities	280
---	Other ATC Manpower	1,943
---	Tenant Manpower**	23,994
Total Mission Manpower		52,549

* Includes US Air Force Academy.

** Tenant manpower is effectively treated by the existing GEBOS-M as other-mission manpower; no attempt is currently made to allocate tenant manpower by PE. Extension of GEBOS-M Air Force-wide should include model modifications to address tenant manpower by function.

TABLE 4.5
AIRCRAFT AND MISSILE INVENTORY, FLYING HOURS, AND
SORTIES BY MISSION/DESIGN/SERIES* - SAC

<u>M/D/S</u>	<u>Number of Aircraft</u>	<u>Flying Hours</u>	<u>Sorties</u>
B-52D	92	32,545	2,224
B-52G	106	47,852	6,496
B-52H	73	36,956	5,207
KC-135A	374	108,661	22,443
KC-135Q	50	14,519	3,115
FB-111A	47	18,085	5,472
EC-135A	5	1,637	2,183
EC-135C	13	11,573	1,547
EC-135G/L	9	3,709	648
E-4A	3	1,764	435
RC-135U	2	903	127
RC-135V	12	3,441	408
C-135A	1	929	459
C-135B	2	972	407

Missiles

LGM-25C (Titan)	18	-	-
LGM-30F+G (Minuteman)	1,000	-	-

* Excludes selected M/D/S systems on which operational data are classified.

TABLE 4.6
AIRCRAFT INVENTORY, FLYING HOURS, AND SORTIES
BY MISSION/DESIGN/SERIES - TAC

<u>M/D/S</u>	<u>Number of Aircraft</u>	<u>Flying Hours</u>	<u>Sorties</u>
A-7D	72	26,311	15,995
A-10A	122	62,221	32,557
F-4C	55	16,375	12,637
F-4D	139	33,675	26,785
F-4E	317	82,895	63,433
F-15A	225	55,293	41,233
F-15B	59	12,116	8,924
F-104G	47	8,309	7,837
F-105F/G	23	4,384	3,666
F-111A/D	162	33,963	14,536
RF-4C	134	35,736	22,319
AC-130H	10	4,229	1,195
O-2A	85	33,372	17,016
OV-10A	11	4,827	2,332
EC-135P	3	975	264
UH-1N/P	18	8,663	6,859
CH-3	8	2,415	1,687
CH-53	4	568	317
T-38A	32	28,411	28,464
T-38B	108	9,316	10,369
F-5E	44	12,649	13,433
MC-130E	5	2,913	953

TABLE 4.7
AIRCRAFT INVENTORY, FLYING HOURS, SORTIES,
AND TRAINING WORKLOADS - ATC

<u>M/D/S</u>	<u>Number of Aircraft</u>	<u>Flying Hours</u>	<u>Sorties</u>
T-37B	511	298,839	239,209
T-38A	533	282,321	227,927
T-41A/C	112	19,321	15,075
T-43A	12	10,097	2,604

TRAINING WORKLOAD

Recruit Training Workload	9,876
Technician Training Workload	25,191
Crypto/Intelligence Training Workload	672
Pilot Training Workload	1,942
Navigator Training Workload	762
Cadet Training Workload	4,499
Professional Education Training Workload	1,569

TABLE 4.8
SELECTED SAC MISSION MANPOWER/AIRCRAFT M/D/S RELATIONSHIPS

<u>Dependent Variable</u>	<u>Explanatory Variables</u>	<u>R²</u>
Bomber Squadron Manpower	= 46.43 (B-52D) + 33.63 (B-52G) + 37.80 (B-52H) + 42.58 (FB-111) + 82.44 (B-52G/H) + 442.45 Training Aircraft	.872
KC-135 Squadron Manpower	= 18.70 (KC-135A) + 21.20 (KC-135Q) + 35.22 (KC-135A) + 69.09 Training Aircraft	.881
Minuteman Squadron Manpower	= 10.46 (LGM-30) + 4.00 Missiles	.925
Titan Squadron Manpower	= 57.75 (LGM-25)	-
SRAM Manpower	= 6.11 (B52-G/H) + 2.20 (FB-111) + 12.25 Aircraft	.951
NEACP Manpower	= 117.33 (E-4A) Aircraft	-

which were based on averages due to limited data availability. Very significant relationships were identified in all cases where data were available.

Table 4.9 contains similar relationships that were identified for TAC. For TAC, the matching of aircraft types and mission program elements was somewhat more complicated than for SAC. Many TAC bases contained substantial manpower in PEC 27597, the training program element. Where several aircraft types were present on a base, such as an installation where A-7s and A-10s were present, and most mission manpower was in PEC 27597, it was not possible to assign training manpower to a specific aircraft type. However, multivariate regression analysis techniques made it possible to estimate manpower/aircraft rates for the principal aircraft types in TAC. Table 4.10 identifies the specific base/program element/aircraft combinations analyzed for TAC.

Table 4.11 illustrates the mission manpower/training workload relationships that were identified for ATC. Training workload data were obtained from the Military Manpower Training Report for FY79 (Department of Defense, March 1978). For ATC, two groups of bases were analyzed: those bases that performed flight training and all other bases. Pilot training workload-per-aircraft relationships are also shown. These relationships enable the model to derive both mission manpower and training aircraft requirements from pilot or navigator training workloads.

On each of Tables 4.8, 4.9, and 4.11 there are listed under the final columns headed " R^2 " statistical measures of the explanatory power of the several coefficients shown for each mission manpower category. In each instance, the explanatory power exceeds the 99% statistical confidence level.

Continuing our key research focus upon the establishment of logical and programmatic linkages between mission capabilities and support manpower/workload, we confirmed that a major retail supply operations workload indicator--total item records--was strongly linked to mission

TABLE 4.9
SELECTED TAC MISSION MANPOWER/AIRCRAFT M/D/S RELATIONSHIPS

<u>Dependent Variable</u>	<u>Explanatory Variables</u>	<u>R²</u>
Mission Manpower	$= 18.19 \text{ (A-7) Aircraft} + 14.73 \text{ (A-1) Aircraft} + 22.68 \text{ (F-4) Aircraft} + 6.41 \text{ (F-5) Aircraft} + 39.99 \text{ (F-15) Aircraft} + 27.60 \text{ (F-111) Aircraft} + 18.96 \text{ (RF-4) Aircraft} + 4.82 \text{ (F-105) Aircraft} + 10.79 \text{ (O-2) Aircraft} - 968.75 \text{ (Exclusions) Aircraft} + 375.04$.981
Airborne Command Post Manpower	$= 110.67 \text{ (EC-135) Aircraft}$	-

TABLE 4.10
TAC AIRCRAFT/MANPOWER DATA GROUPINGS

<u>Base</u>	<u>Manpower Program Element Codes</u>	<u>Aircraft</u>
Bergstrom	27213, 27597	RF-4
Bergstrom	27412	O-2, OV-10A
Cannon	27129, 27597	F-111
Davis Monthan	27131, 27597	A-10
Davis Monthan	27412	O-2
England	27121, 27597	A-7
George	27128, 27597	F-4
George	27127	F-105
Holloman	27130, 27597	F-15, T-38A
Homestead	27128, 27597	F-4
Langley	21120	EC-135P
Langley	27130, 27597	F-15
Luke	27128, 27130, 27597	F-4, F-15
MacDill	27128, 27597	F-4
Moody	27128, 27597	F-4
Mountain Home	27129, 27597	F-111
Myrtle Beach	27131, 27597	A-10
Nellis	27128, 27597	A-10, F-4, F-15
Nellis	27218	F-5
Nellis	27128	F-4
Seymour Johnson	27128, 27597	F-4
Shaw	27213, 27597	RF-4
Shaw	27412	O-2

TABLE 4.11
ATC MISSION MANPOWER ANALYSIS

<u>Dependent Variable</u>	<u>Explanatory Variables</u>	<u>R²</u>
UPT Mission Manpower	= 3.8219 (T37B/T38A) + 36.8811 (T43A) - 432.7 (Exclusions) + 567.4	.963
Other Training Mission Manpower	= .8921 (Professional/Career + .451 (Technician + Education Training Workload) + 1.5309 (Crypto/Intelligence + .1865 (Recruit Training + Training Workload) + 1.0208 (Cadet Training - 634.7 Workload)	.938
T-37B/T-38A Aircraft	= 2.16 (Pilot Training Workload)	.793
T-43A Aircraft	= 63.5 (Navigator Training Workload)	-

requirements. These relationships between total item records and mission indicators are identified in Table 4.12. Basically, the presence of a particular aircraft or missile system on a base was the major determinant of supply workload. For example, in TAC it did not matter how many F-15s were present on a base, but whether any were present at all. Apparently, the number of item records necessary to maintain a particular weapon system is relatively fixed once that weapon system is established. In a similar context, note in Table 4.12 that tenant manpower also proved a significant workload determinant. Tenant manpower was an approximation for the supply workload generated by specific tenant missions. Assuming extension of GEBOS-M Air Force-wide, specific tenant missions could be accounted for explicitly.

Tables 4.13 through 4.15 illustrate observed and predicted item records by base for SAC, TAC, and ATC.

Tables 4.16 through 4.18 show the sorties per flying hour rates by M/D/S for SAC, TAC, and ATC. These rates are based upon FY79 command averages. They were used for estimating mission capability changes and selected support workload changes.

Tables 4.19 through 4.21 provide the FY79 aviation fuel consumption rates by M/D/S for SAC, TAC, and ATC. They were used to determine aviation fuel consumption changes from flying hour changes.

Table 4.22 contains other mission/support workload relationships identified in the model. These include missiles/miles driven for SAC and sorties/miles driven for TAC. These proved to be significant correlations that further linked support manpower/workload to mission capability.

4.3 SUMMARY

By way of summary, Table 4.23 lists the primary linkages between BOS/RPMA workload indicators and mission capability measures.

TABLE 4.12
ITEM RECORDS ANALYSIS

<u>Command</u>	<u>Dependent Variable</u>	<u>Explanatory Variables</u>	<u>R²</u>
SAC	Total Item Records =	1.1663 (Tenant Population) + 1984.9 (B-52) + Base	
		156.90 (KC-135) + 2008.3 (F-111) + 697.8 (F-106) + Base	
		3919.7 (E-4A) + 1153.3 (Minuteman) + 975.0 (Titan) + Base	
		2453.5 (Additives) + 2445.6	.894
TAC	Total Item Records =	2.2776 (Tenant Population) + 1398.5 (F-4) + Base	
		3054.6 (F-15) + 1544.0 (F-111) + 2990.8 (RF-4) + Base	
		400.5 (A-10) + 4613.16 Base	.885
ATC	Total Item Records =	.3601 (Tenant Population) + .4689 (Student Authorizations) + 1344.0 (UPT Base) - 2757.3 (Exclusions) + 3202.7	.916

TABLE 4.13
COMPARISON OF OBSERVED AND PREDICTED ITEM RECORDS FOR SAC

<u>Base</u>	<u>Observed Item Records</u>	<u>Predicted Item Records</u>	<u>Difference</u>
Anderson	10,397	10,372	25
Barksdale	10,072	10,072	0
Beale	9,217	8,758	459
Blytheville	8,459	6,995	1,464
Carswell	7,915	7,054	861
Castle	7,737	7,812	-75
Dyess	7,681	7,138	543
Ellsworth	7,648	7,157	494
F. E. Warren	7,574	7,599	-25
Fairchild	7,444	7,687	-243
Grand Forks	7,107	8,612	-1,505
Griffiss	6,988	6,682	306
Grisson	6,774	7,204	-430
K. I. Sawyer	6,728	6,825	-97
Loring	6,709	6,567	142
Malmstrom	6,348	6,399	-51
March	6,295	6,601	-306
McConnell	5,820	5,820	0
Minot	5,744	6,335	-591
Offutt	5,496	6,325	-829
Pease	5,477	5,477	0
Plattsburgh	5,293	4,877	416
Rickenbacker	4,628	4,628	0
Vandenberg	4,226	4,226	0
Whiteman	4,122	4,148	-26
Wurtsmith	3,611	4,142	-531

TABLE 4.14
COMPARISON OF OBSERVED AND PREDICTED ITEM RECORDS FOR TAC

<u>Base</u>	<u>Observed Item Records</u>	<u>Predicted Item Records</u>	<u>Difference</u>
Bergstrom	12,844	12,048	796
Cannon	11,431	10,314	1,117
Davis Monthan	11,272	11,604	-332
England	10,833	12,414	-1,581
George	9,791	8,948	843
Holloman	9,719	8,920	799
Homestead	9,600	9,831	-231
Howard	9,243	9,672	-429
Eglin/Hurlburt	8,784	8,684	100
Langley	8,722	8,822	-100
Luke	8,371	7,039	1,332
MacDill	6,955	6,594	361
Moody	6,571	6,932	-361
Mountain Home	6,044	5,813	231
Myrtle Beach	5,421	5,823	-402
Nellis	5,376	5,276	100
Seymour Johnson	5,087	6,848	-1,761
Shaw	4,904	5,388	-484

TABLE 4.15
COMPARISON OF OBSERVED AND PREDICTED ITEM RECORDS FOR ATC

<u>Base</u>	<u>Observed Item Records</u>	<u>Predicted Item Records</u>	<u>Difference</u>
Chanute	5,008	5,551	-543
Columbus	4,371	4,823	-452
Keesler	9,572	9,572	0
Lackland	2,918	2,918	0
Laughlin	4,208	4,795	-587
Lowry	6,603	6,570	33
Mather	9,022	9,022	0
Maxwell	4,293	4,103	190
Randolph	5,574	5,699	-125
Reese	4,598	4,772	-174
Sheppard	6,662	5,824	838
Williams	6,163	4,826	1,337
USAF Academy	4,856	5,374	-518

TABLE 4.16
 SORTIES PER FLYING HOUR BY MISSION/DESIGN/SERIES
 SAC

<u>M/D/S</u>	<u>Sorties/ Flying Hour</u>
B-52D	0.0683
B-52G	0.1358
B-52H	0.1409
KC-135A	0.2065
KC-135Q	0.2145
FB-111A	0.3026
EC-135A	0.1832
EC-135C	0.1337
EC-135G/L	0.1747
E-4A	0.2466
RC-135U	0.1406
RC-135V	0.1186
C-135A	0.4941
C-135B	0.4187

TABLE 4.17
SORTIES PER FLYING HOUR BY MISSION/DESIGN/SERIES
TAC

<u>M/D/S</u>	<u>Sorties/ Flying Hour</u>
A-7D	0.6079
A-10A	0.5232
F-4C	0.7717
F-4D	0.7954
F-4E	0.7652
F-15A	0.7457
F-15B	0.7365
F-104G	0.9432
F-105F/G	0.8362
F-111A/D	0.4280
RF-4C	0.6246
AC-130H	0.2826
O-2A	0.5099
OV-10A	0.4831
EC-135P	0.2708
UH-1N/P	0.7918
CH-3	0.6986
CH-53	0.5581
T-38A	1.0019
T-38B	1.1130
F-5E	1.0620
MC-130E	0.3272

TABLE 4.18
 SORTIES PER FLYING HOUR BY MISSION/DESIGN/SERIES
 ATC

<u>M/D/S</u>	<u>Sorties/ Flying Hour</u>
T-37B	0.8005
T-38A	0.8073
T-41A/C	0.7802
T-43A	0.2579

TABLE 4.19
FUEL CONSUMPTION RATES BY MISSION/DESIGN/SERIES PER FLYING HOUR
SAC

<u>M/D/S</u>	<u>Fuel Consumption Rate (Gallons/Hour)</u>
B-52D	4,005
B-52G	3,980
B-52H	3,325
KC-135A	2,330
KC-135Q	2,180
FB-111A	1,500
EC-135A	1,950
EC-135C	1,950
EC-135G/L	1,950
E-4A	4,070
RC-135U	1,850
RC-135V	1,850
C-135A	1,825
C-135B	1,825

Source: USAF Cost and Planning Factors Guide, AFP 173-13, 31 May 1979,
pp. 43-47.

TABLE 4.20
FUEL CONSUMPTION RATES BY MISSION/DESIGN/SERIES PER FLYING HOUR
TAC

<u>M/D/S</u>	<u>Fuel Consumption Rate (Gallons/Hour)</u>
A-7D	685
A-10A	515
F-4C	1,555
F-4D	1,535
F-4E	1,570
F-15A	1,395
F-15B	1,395
F-104G	800
F-105F	1,285
F-105G	1,375
F-111A/D	1,500
RF-4C	1,335
AC-130H	705
O-2A	25
OV-10A	95
EC-135P	1,950
UH-1N	90
UH-1P	70
CH-3	150
CH-53	290
T-38A	390
T-38B	390
F-5E	575
MC-130E	775

Source: USAF Cost Planning Factors Guide, AFP 173-13, 31 May 1979, pp. 43-47.

TABLE 4.21
FUEL CONSUMPTION RATES BY MISSION/DESIGN/SERIES PER FLYING HOURS
ATC

<u>M/D/S</u>	<u>Fuel Consumption Rate (Gallons/Hour)</u>
T-37B	180
T-38A	390
T-41A/C	8
T-43A	850

Source: USAF Cost and Planning Factors Guide, AFP 173-13, 31 May 1979,
pp. 43-47.

TABLE 4.22
MISSION/MILES DRIVEN RELATIONSHIPS

<u>Command</u>	<u>Dependent Variable</u>	<u>Explanatory Variables</u>	<u>R²</u>
SAC	Miles Driven	= .1883 (Base Population) + 4122.5 (Minuteman Base) + 1611.7 (Titan Base) + 1536.6	.804
TAC	Miles Driven	= .05596 (Sorties Flown) + 1254.1 (Davis Monthan) + 1170.5	.563

TABLE 4.23
RELATIONSHIPS BETWEEN BOS/RPMA WORKLOAD
INDICATORS AND MISSION CAPABILITY MEASURES

<u>Program Element</u>	<u>BOS/RPMA Workload Indicator</u>	<u>Mission Capability Indicator</u>
11894	Base Population	Aircraft, Missiles, Squadrons, Direct Mission Manpower
11896	Base Population	Aircraft, Missiles, Squadrons, Direct Mission Manpower
	Total Item Records	Aircraft Squadrons, Missile Squadrons
	Aviation Fuel Consumption Miles Driven	Aircraft Flying Hours Missiles
27594	Base Population	Aircraft, Squadrons, Direct Mission Manpower
27596	Base Population	Aircraft, Squadrons, Direct Mission Manpower
	Total Item Records	Aircraft Squadrons
	Aviation Fuel Consumption Miles Driven	Aircraft Flying Hours Aircraft Sorties
85794	Base Population	Aircraft, Training Workload, Direct Mission Manpower
85796/ 85896	Base Population	Aircraft, Training Workload, Direct Mission Manpower
	Total Item Records	Aircraft, Training Workload
	Aviation Fuel Consumption	Aircraft Flying Hours
	Students Authorized	Training Workload
	Weighted Rations Served	Training Workload

SECTION 5

GEBOS-M MODEL DESIGN

The GEBOS-M model is a sophisticated and flexible manpower planning tool. It is composed of a number of separate program and data files. The listings of the programs and a description of the variables contained within them is provided in Appendix D. This section describes the relationships between the programs and data files, the input options available to the user, samples of the program output, descriptions of the structure of the key data files, and a discussion of the linear programming module.

5.1 GEBOS-M SYSTEM DIAGRAM

Figure 5.1 presents a schematic diagram of the GEBOS-M system. The "core" of the system is the computer disk file containing the program NBOSPG. This file is user-interactive, providing the user with the required prompts. Depending upon the responses to these prompts, NBOSPG accesses the data contained in one or more of the command files (ATCFL, SACFL, or TACFL). Once the user has responded to all the relevant options requested by NBOSPG, and if the mission impact mode has been selected, sub-routines MISSUB and SUBLP are called. MISSUB acts as a mission pre-processor. It computes workload changes and mission capability and mission manpower changes based upon the mission changes entered by the user. It does so by accessing the appropriate mission data files (ATCOM, ATCTR, SACOP, SACTR, TACOP, TACTR). SUBLP then employs the linear programming modules to perform the actual manpower requirement calculations by utilizing the output of MISSUB and the command files, and by calling the data contained in its own subroutines, MATGEN, RAWIA, REITA, and RIVO. NBOSPG's output display format then prints the results of SUBLP's computations.

If, instead of the mission mode, the user selects either the workload change or manpower change modes, NBOSPG follows a similar procedure, except that MISSUB is bypassed and SUBLP is called directly. In these modes, SUBLP will compute manpower requirements from workload change inputs or workload changes from manpower change inputs.

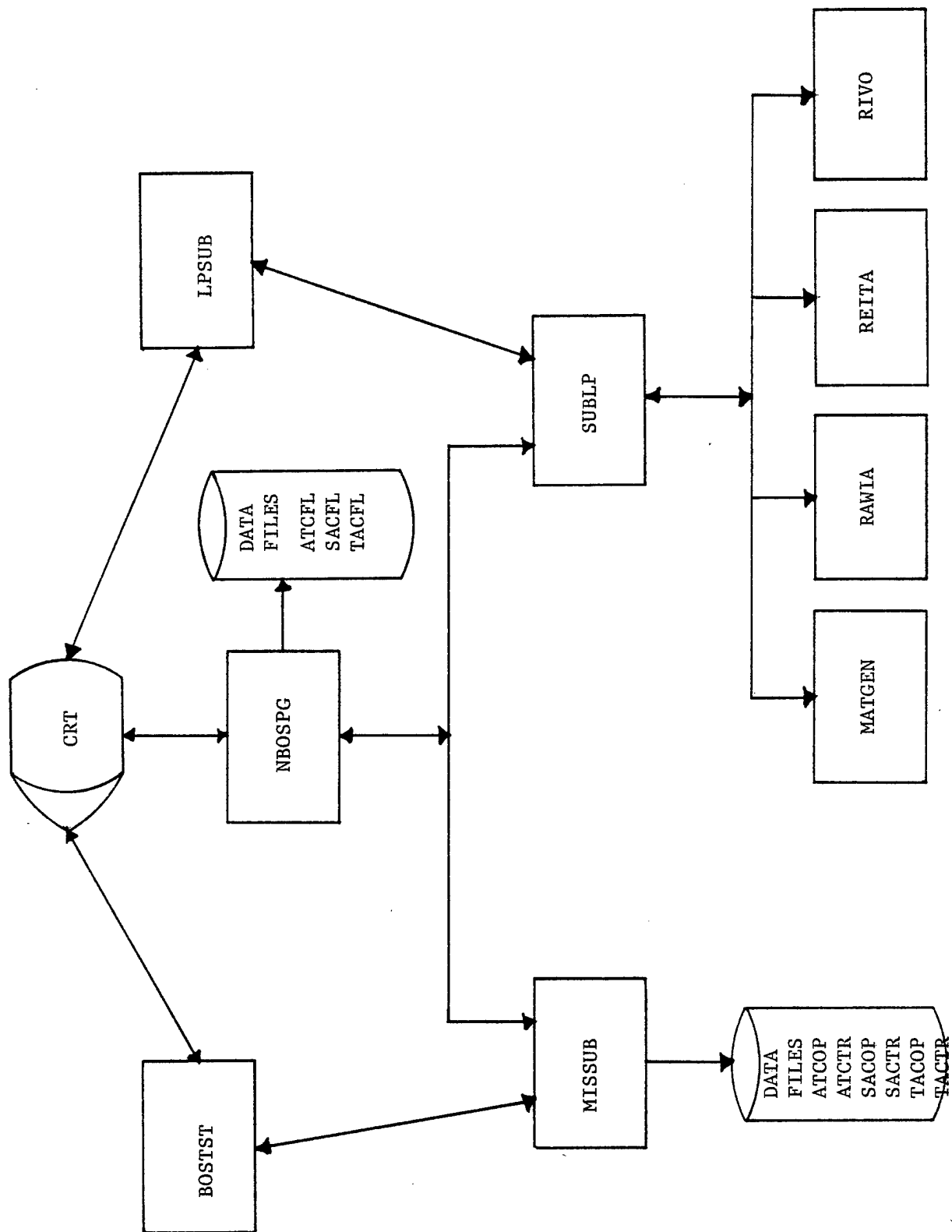


Figure 5.1. GEBOS-M Systems Diagram

Within the GEBOS-M system, the user has the additional option of bypassing NBOSPG entirely and executing directly the subroutines MISSUB or SUBLP by means of, respectively, the programs BOSTST and LPSUB.

5.2 USER PROGRAM GUIDE

Figure 5.2 presents a sample GEBOS-M program run in the mission impact mode in which 18 F-111A/D aircraft have been added to TAC. The user is prompted for a number of inputs. First, the program prompts the user to identify the particular command to which changes are to be made (in this case, TAC, entered as "3"). The user must then identify the change option to be employed, in which the type of change is entered. The user has three such options: he may make changes to either workload, BOS manpower, or mission capabilities. The original GEBOS model provided the capability to explain and justify manpower and workload changes, while GEBOS-M provides the additional capability to analyze how changes to mission capability impact upon support workload and manpower requirements. In this example, the user has selected the mission impact made by entering "3" (which identifies the mission option). Next, mission type must be entered. Two options are available: typical and operational. If the typical mission type is selected, the program will make its computations using "typical" predicted mission data contained in the file TACTR. Conversely, as in this example, if the operational mission type is selected, computations will be made utilizing actual "operational" mission data from FY79¹ contained in the file TACOP (see Section 5.3). In the situations analyzed by GRC, the operational mode was always selected.

The user, having entered the command (TAC), change option (mission impact mode), and mission type (operational), is presented with a series of mission capability change options. First, the program lists the aircraft (and missiles, for SAC) for which changes may be made in the selected command. Each aircraft is identified by mission, design, and

¹The reader will recognize that FY79 data are the latest now contained in the GEBOS-M data base. Hence the reference to FY79 data throughout this user guide. As the data base is updated in future, model computations will be based upon that updated baseline.

INBOSP6

MISSION IMPACT GENERALIZED EXPLANATORY
BASE OPERATING SUPPORT MODEL (GEBOS-M)

ENTER COMMANDS (1=ATC, 2=SAC, 3=TAC):

3

ENTER CHANGE OPTION (1=MANPOWER, 2=WORKLOAD, 3=MISSION):

3

ENTER MISSION TYPE (1=TYPICAL, 2=OPERATIONAL):

2

AIRCRAFT M/D/S TYPES:

- 1=A-7D
- 2=A-10A
- 3=F-4C
- 4=F-4D
- 5=F-4E
- 6=F-15A
- 7=F-15B
- 8=F-104B
- 9=F-105F/G
- 10=F-111A/D
- 11=RF-4C
- 12=AC-130H
- 13=O-2A
- 14=OV-10A
- 15=EC-135P
- 16=UH-1H/P
- 17=CH-53
- 18=CH-53
- 19=T-38A
- 20=T-38B
- 21=F-5E
- 22=MC-130E

ENTER THE NUMBER OF AIRCRAFT/FLYING HOUR CHANGES TO BE MADE:

1.1

ENTER AIRCRAFT M/D/S TYPE, CHANGE IN NUMBER OF AIRCRAFT,
AND CHANGE IN NUMBER OF FLYING HOURS
(ON EACH LINE, ENTER CHANGES FOR ONE M/D/S TYPE):

10.18.240

Figure 5.2. Sample GEBOS-M Model Display for TAC
(Mission Impact Mode)

OTHER MISSION CAPABILITY:

- 1=OPERATIONAL HEADQUARTERS (TAF)
- 2=SPECIAL OPERATIONS FORCE
- 3=TACTICAL AIR CONTROL SYSTEM COMMAND
- 4=TACTICAL FIGHTER WEAPONS CENTER RANGE
- 5=CIVIL ENGINEER SQUADRONS (AV REPAIR)
- 6=TACTICAL AIR INTELLIGENCE SYS ACTIVITIES
- 7=TRAINING-TACTICAL AIR FORCES
- 8=MGT HQ (TACTICAL AIR FORCES)
- 9=COMBAT DEVELOPMENTS
- 10=WRM-EQUIPMENT/SECONDARY ITEMS
- 11=CARE IN REGIONAL DEFENSE FACILITIES
- 12=DENTAL CARE ACTIVITIES
- 13=STATION HOSPITALS AND MEDICAL CLINICS
- 14=OTHER TAC
- 15=TENANT MANPOWER
- 16=MILITARY HOUSING FLOOR SPACE
- 17=NON-HOUSING FLOOR SPACE
- 18=MILITARY VEHICLES
- 19=A-7 SQUADRONS
- 20=A-10 SQUADRONS
- 21=F-4 SQUADRONS
- 22=RF-4 SQUADRONS
- 23=F-15 SQUADRONS
- 24=F-105 SQUADRONS
- 25=F-5 SQUADRONS
- 26=F-111 SQUADRONS

ENTER THE NUMBER OF OTHER MISSION CHANGES TO BE MADE:

1

ENTER TYPE OF OTHER MISSION CAPABILITY, CHANGE IN QUANTITY
(ON EACH LINE, ENTER CHANGES FOR ONE TYPE OF OTHER SUPPORTS):

26,1

ENTER PRINT OPTION AS FOLLOWS:

- 1=DISPLAY MILITARY/CIVIL BREAKOUT
- 2=DISPLAY TOTAL MANPOWER ONLY

PRINT OPTION IS:

2

Figure 5.2 (Continued)

TACTICAL AIR COMMAND

OPERATIONAL MISSION CAPABILITY

AIRCRAFT CAPABILITY

AIRCRAFT INVENTORY:

M/D/S	FY79 AIRCRAFT	CHANGE	RESULTANT AIRCRAFT	PERCENT CHANGE
A-7D	72.0	0.	72.0	0.
A-10A	122.0	0.	122.0	0.
F-4C	55.0	0.	55.0	0.
F-4D	139.0	0.	139.0	0.
F-4E	317.0	0.	317.0	0.
F-15A	225.0	0.	225.0	0.
F-15B	59.0	0.	59.0	0.
F-104G	47.0	0.	47.0	0.
F-105F/G	23.0	0.	23.0	0.
F-111A/D	162.0	18.0	180.0	11.11
RF-4C	134.0	0.	134.0	0.
AC-130H	10.0	0.	10.0	0.
O-2A	85.0	0.	85.0	0.
OV-10A	11.0	0.	11.0	0.
EC-135P	3.0	0.	3.0	0.
QH-1N/P	18.0	0.	18.0	0.
CH-3	8.0	0.	8.0	0.
CH-53	4.0	0.	4.0	0.
T-38A	32.0	0.	32.0	0.
T-38B	108.0	0.	108.0	0.
F-5E	44.0	0.	44.0	0.
MC-130E	5.0	0.	5.0	0.
TOTAL	1683.0	18.0	1701.0	1.07

Figure 5.2 (Continued)

FLYING HOURS:

M/D/S	FY79 FLY HRS	CHANGE	RESULTANT FLY HRS	PERCENT CHANGE
A-7D	26311.0	0.	26311.0	0.
A-10A	62221.0	0.	62221.0	0.
F-4C	16375.0	0.	16375.0	0.
F-4D	33675.0	0.	33675.0	0.
F-4E	82895.0	0.	82895.0	0.
F-15A	55293.0	0.	55293.0	0.
F-15B	12116.0	0.	12116.0	0.
F-104G	8309.0	0.	8309.0	0.
F-105F/G	4384.0	0.	4384.0	0.
F-111A/D	33963.0	4320.0	38283.0	12.72
RF-4C	35736.0	0.	35736.0	0.
HC-130H	4229.0	0.	4229.0	0.
Q-2A	33372.0	0.	33372.0	0.
OV-10A	4827.0	0.	4827.0	0.
EC-135P	975.0	0.	975.0	0.
UH-1N/P	8663.0	0.	8663.0	0.
CH-53	2415.0	0.	2415.0	0.
CH-53	568.0	0.	568.0	0.
T-38A	28411.0	0.	28411.0	0.
T-38B	9316.0	0.	9316.0	0.
F-5E	12649.0	0.	12649.0	0.
MC-130E	2913.0	0.	2913.0	0.
TOTAL	479616.0	4320.0	483936.0	.90

Figure 5.2 (Continued)

SORTIES:

M/D/S	FY79 SORTIES	CHANGE	RESULTANT SORTIES	PERCENT CHANGE
H-7D	15995.0	0.	15995.0	0.
H-10A	32557.0	0.	32557.0	0.
F-4C	12637.0	0.	12637.0	0.
F-4D	26785.0	0.	26785.0	0.
F-4E	63433.0	0.	63433.0	0.
F-15A	41233.0	0.	41233.0	0.
F-15B	8924.0	0.	8924.0	0.
F-104G	7837.0	0.	7837.0	0.
F-105F/G	3666.0	0.	3666.0	0.
F-111A/D	14536.0	1849.0	16385.0	12.72
RF-4C	22319.0	0.	22319.0	0.
AC-130H	1195.0	0.	1195.0	0.
D-2A	17016.0	0.	17016.0	0.
OV-10A	2332.0	0.	2332.0	0.
EC-135P	264.0	0.	264.0	0.
OH-1A/P	6859.0	0.	6859.0	0.
CH-53	1687.0	0.	1687.0	0.
T-38A	317.0	0.	317.0	0.
T-38B	28464.0	0.	28464.0	0.
F-5E	10369.0	0.	10369.0	0.
MC-130E	13433.0	0.	13433.0	0.
	953.0	0.	953.0	0.
TOTAL	332311.0	1849.0	334160.0	.56

Figure 5.2 (Continued)

OTHER MISSION CAPABILITY

	FY79 QUANTITY	CHANGE	RESULTANT QUANTITY	PERCENT CHANGE
OPERATIONAL HEADQUARTERS (TAF)	215.0	0.	215.0	0.
SPECIAL OPERATIONS FORCE	1577.0	0.	1577.0	0.
TACTICAL AIR CONTROL SYSTEM COMMAND	572.0	0.	572.0	0.
TACTICAL FIGHTER WEAPONS CENTER RANGE	932.0	0.	932.0	0.
CIVIL ENGINEER SQUADRONS (HV REPAIR)	400.0	0.	400.0	0.
TACTICAL AIR INTELLIGENCE SYS ACTIVITIES	468.0	0.	468.0	0.
TRAINING-TACTICAL AIR FORCES	13049.0	0.	13049.0	0.
MST HQ (TACTICAL AIR FORCES)	2424.0	0.	2424.0	0.
COMBAT DEVELOPMENTS	694.0	0.	694.0	0.
WAM-EQUIPMENT/SECONDARY ITEMS	360.0	0.	360.0	0.
CARE IN REGIONAL DEFENSE FACILITIES	340.0	0.	340.0	0.
DENTAL CARE ACTIVITIES	664.0	0.	664.0	0.
STATION HOSPITALS AND MEDICAL CLINICS	3926.0	0.	3926.0	0.
OTHER TAC	2601.0	0.	2601.0	0.
TENANT MANPOWER	15929.0	0.	15929.0	0.
MILITARY HOUSING FLOOR SPACE	27020.0	0.	27020.0	0.
NON-HOUSING FLOOR SPACE	39627.0	0.	39627.0	0.
MILITARY VEHICLES	497.0	0.	497.0	0.
A-7 SQUADRONS	1.0	0.	1.0	0.
A-10 SQUADRONS	2.0	0.	2.0	0.
F-4 SQUADRONS	3.0	0.	3.0	0.
RF-4 SQUADRONS	2.0	0.	2.0	0.
F-15 SQUADRONS	4.0	0.	4.0	0.
F-105 SQUADRONS	1.0	0.	1.0	0.
F-5 SQUADRONS	1.0	0.	1.0	0.
F-111 SQUADRONS	2.0	1.0	3.0	50.00
TOTAL	111316.0	1.0	111317.0	.00

MISSION MANPOWER

	FY79 MISSION MP	CHANGE	RESULTANT MISSION MP	PERCENT CHANGE
AIRBORNE COMMAND POST (CINCLANT)	332.0	0.	332.0	0.
A-7 SQUADRONS	1676.0	0.	1676.0	0.
F-105 SQUADRONS	486.0	0.	486.0	0.
F-4 SQUADRONS	10533.0	0.	10533.0	0.
F-111 SQUADRONS	3809.0	871.8	4680.8	22.89
F-15 SQUADRONS	3632.0	0.	3632.0	0.
A-10 SQUADRONS	1349.0	0.	1349.0	0.
RF-4 SQUADRONS	2511.0	0.	2511.0	0.
TACTICAL FIGHTER TNG (AGGRESSOR) SQUAD	657.0	0.	657.0	0.
TACTICAL AIR CONTROL SYSTEM	3768.0	0.	3768.0	0.
OTHER MISSION MANPOWER	44151.0	0.	44151.0	0.
TOTAL	72904.0	871.8	73775.8	1.20

Figure 5.2 (Continued)

OUTPUT/WORKLOAD				
WORKLOAD INDICATOR	FY79 INDICATOR	CHANGE	RESULTANT INDICATOR	PERCENT CHANGE
POPULATION INDICATORS				
TOTAL BASE POPULATION	100435.6	998.0	101433.6	1.0
TOTAL BASE MISSION POPULATION	72903.6	871.8	73775.4	1.2
TOTAL BASE MILITARY POPULATION	83763.3	832.3	84595.6	1.0
TOTAL BASE CIVILIAN POPULATION	16672.3	165.7	16838.0	1.0
TOTAL BASE AIRMEN POPULATION	72153.7	716.9	72870.7	1.0
TOTAL AFM MANPOWER	8599.0	18.5	8617.5	.2
TOTAL BOS MANPOWER	18933.0	107.6	19040.6	.6
REAL PROPERTY MAINTENANCE				
MILITARY FAMILY HOUSING FLOOR SPACE	27019.2	0.	27019.2	0.
MILITARY FAMILY HOUSING UNITS	10557.1	0.	10557.1	0.
NON-HOUSING FLOOR SPACE	39628.0	0.	39628.0	0.
UTILITIES				
TOTAL ENERGY CONSUMPTION	8125.0	0.	8125.0	0.
TOTAL ELECTRICITY CONSUMPTION	1040039.0	0.	1040039.0	0.
ADMINISTRATION				
TRAVEL TRANSACTIONS	82092.0	2450.6	84542.6	3.0
TOTAL BOS BUDGET	585587.1	1531.5	587118.6	.3
TRANSACTIONS AUDITED	401390.7	3199.5	404590.3	.8
TOTAL AIR FORCE MEMBERS SERVICED	93593.6	916.4	94510.1	1.0
CIVILIAN PAY ACCOUNTS	15241.9	159.3	15401.2	1.0
COMMERCIAL SERVICES TRANSACTIONS	71090.9	339.1	71430.0	.5
MATERIEL TRANSACTION WORKLOAD	18633.9	170.9	18804.8	.9
SUPPLY				
TOTAL TRANSACTIONS	1581873.5	16355.9	1598229.4	1.0
SUPPLY TRANSACTIONS	1383893.6	14308.9	1398202.4	1.0
EQUIPMENT TRANSACTIONS	197980.8	2047.0	200027.9	1.0
TOTAL ITEM RECORDS	151017.8	1544.0	152561.8	1.0
SUPPLY ITEM RECORDS	131476.1	1344.2	132820.3	1.0
EQUIPMENT ITEM RECORDS	19541.7	199.8	19741.5	1.0
AVIATION FUEL	54731.0	540.0	55271.0	1.0
MAINTENANCE OF INSTALLATION EQUIPMENT				
MILES DRIVEN	37167.0	103.7	37270.7	.3
VEHICLE EQUIVALENTS	19413.0	22.2	19435.2	.1
TOTAL VEHICLES	9295.0	11.9	9306.9	.1
MILITARY VEHICLES	497.0	0.	497.0	0.
NON-MILITARY VEHICLES	8798.0	11.9	8809.9	.1
BACHELOR HOUSING				
VISITING AIRMEN BEDS	1663.0	17.1	1680.1	1.0
OTHER PERSONNEL SUPPORT				
WEIGHTED RATIONS	334274.5	2447.2	336721.7	.7

Figure 5.2 (Continued)

TACTICAL AIR COMMAND

FUNCTIONAL MANPOWER (TOTAL)

FUNCTION	FY79 MANPOWER	CHANGE	RESULTANT MANPOWER	PERCENT CHANGE
MAINTENANCE & REPAIR OF REAL PROPERTY	5422.0	15.8	5437.8	.29
OPERATION OF UTILITIES FOR ALL REAL PROP	1088.0	-1.0	1088.0	-.00
OTHER ENGINEERING SUPPORT	2089.0	2.7	2091.7	.13
ADMINISTRATION	4648.0	13.1	4661.1	.28
RETAIL SUPPLY OPERATIONS	5910.0	38.7	5948.7	.66
MAINTENANCE OF INSTALLATION EQUIPMENT	1082.0	1.6	1083.6	.15
OTHER BASE SERVICES	4582.0	34.7	4616.7	.76
BACHELOR HOUSING OPERATIONS & FURNISHING	207.0	.3	207.3	.16
MORALE, WELFARE, & RECREATION	642.0	1.4	643.4	.21
OTHER PERSONNEL SUPPORT	1862.0	17.8	1879.8	.95
TOTAL	27532.0	126.1	27658.1	.46

MANPOWER SLACK VARIABLES

FUNCTION	SLACK
MAINTENANCE & REPAIR OF REAL PROPERTY	0.
OPERATION OF UTILITIES FOR ALL REAL PROP	0.
OTHER ENGINEERING SUPPORT	0.
ADMINISTRATION	0.
RETAIL SUPPLY OPERATIONS	0.
MAINTENANCE OF INSTALLATION EQUIPMENT	0.
OTHER BASE SERVICES	0.
BACHELOR HOUSING OPERATIONS & FURNISHING	0.
MORALE, WELFARE, & RECREATION	0.
OTHER PERSONNEL SUPPORT	0.

ENTER ITERATION OPTION AS FOLLOWS:
1=ACCUMULATE CHANGES,2=BEGIN NEW CYCLE,3=STOP
ITERATION OPTION=
3
STOP RUN COMPLETE
SPURS:11.7
!

Figure 5.2 (Continued)

series (M/D/S). The user then enters the number of aircraft changes (in this case, "1") and the number of flying hour changes ("1") to be made. Reductions in aircraft or flying hours must be negative numbers. Again prompted by the program, the user enters the specific aircraft changes to be made. Changes to each aircraft type are entered on separate lines. For each aircraft change, the user enters the aircraft type code ("10" in this example), the number of aircraft to be changed ("18"), and the number of flying hours per aircraft to be changed ("240"). These aircraft changes entered, the model now lists other mission capability change options. Again, the user enters the number of such other mission changes to be made and, subsequently, the applicable other mission capability code and absolute numerical change to be made. Separate changes are again listed on separate lines (in this case, one F-111 squadron has been added, entered as "26,1"). Finally, the user may select one or two print options. Manpower changes may be displayed in a military/civilian breakout, in which the numbers of officers, airmen, civilians, and CMYEs are separately tabulated along with total manpower or, alternatively, total manpower alone may be displayed. In this example, the second option has been selected (entered as "2").

User input complete, the model now moves through the various steps described in Section 5.1.

At the head of the output display appears the command name. Under it, a summary of mission capability changes is printed. For TAC, these include aircraft capability changes, other mission capability changes, and mission manpower changes. Under the heading of "Aircraft Capability," a summary of aircraft inventory is printed, indicating FY79 numbers of each aircraft type, the change in number as input by the user, the resultant value, and the percentage change. The model employs the same general format in all subsequent tables (except for manpower slack variables). The first column is used to concisely identify the data printed in each line of each table. The second column contains the FY79 indicator value, the third column indicates the absolute change in that value, the fourth column indicates the resultant value, and the last column indicates the

percentage change. Column totals are also printed. Following the summary of aircraft inventory, the model prints a display table summarizing flying hours and their corresponding changes for each aircraft type, and a third table indicating values and calculated changes for number of sorties by aircraft type.

Under the heading "Other Mission Capability," the model displays a table listing values and user input changes for other mission capability indicators. Finally, under the heading "Mission Manpower," the model prints a display table indicating mission manpower values and their calculated changes for the various mission systems.

Following these initial summaries of mission capabilities and their respective changes, the model computes the corresponding changes to selected workload indicators. The values of these indicators and their changes are displayed in a table entitled "Output/Workload." In this particular example, all but six workload indicators (see page 5-10) have been affected by the addition of the F-111 aircraft.

The model next displays changes to BOS/RPMA manpower requirements based upon the changes to the selected workload indicators. These changes are indicated by functional category, and are displayed in a table entitled "Functional Manpower." If the user has selected the military/civilian breakout print option, the model prints four additional tables presenting the total manpower change breakdown in terms of, respectively, officers, airmen, civilians, and CMYEs.

Finally, the model prints a table listing values of manpower slack variables by functional category. In the mission impact mode, these should all be 0, since the manpower allocation should be efficient.

5.3 DESCRIPTION OF MISSION DATA FILES

This section provides a detailed description of the mission operational data files using the SACOP file as an example (other command files are similar and the listings for ATCOP and TACOP are presented in detail

in Appendix E). Line spacing was provided as we constructed each file to allow data to be interspersed in an orderly fashion at appropriate points as our research progressed. Accordingly, the SACOP data file appearing in Figure 5.3 and the descriptive summary which follows do not use consecutive data file lines throughout, but allow adequate spacing for possible future use.

- Line 10 contains the name of the particular command to which the file pertains.
- Line 20 contains the file title "Operational Mission Capability."
- Lines 30 through 510 contain data on mission manpower, other manpower, other mission capabilities, missiles, and aircraft listed, respectively, in five sections. The numbers listed on lines 30, 110, 300, 340, and 370 indicate, respectively, the number of lines containing data within each of the five sections.
 - Mission Manpower: Lines 40 through 101 contain mission manpower. On each line, the first column either indicates FY79 manpower for a specific mission manpower program element, or FY79 total manpower for a group of mission manpower program elements. The second column either lists the appropriate specific program element (PE) code, or a series of five dashes where the manpower data concerned reflect the total for a group of mission manpower PE codes. The third column contains either the appropriate definition of a specific PE or a sufficiently descriptive term to clearly identify the aggregation of PEs being described (e.g., "other mission manpower," or "tenant manpower," or the like).
 - Other Manpower: Lines 120 through 290 contain other manpower data organized like mission manpower in essentially the same format (FY79 total manpower, PE code, and definition listed in that order on each line).

```

LIST SACOP
10      STRATEGIC AIR COMMAND
20      OPERATIONAL MISSION CAPABILITY
30      8
40      18418.0 11113 B-52 SQUADRONS
50      29524.0 11115 FB-111 SQUADRONS
60      1491.0 11118 SRAM (ARM-63)
70      10395.0 11142 KC-135 SQUADRONS
80      2061.0 11212 TITAN SQUADRONS
90      10594.0 11213 MINUTEMAN SQUADRONS
100     352.0 32015 NATL EMERGENCY AIRBORNE CMD POST-NEOP
101     44733.0 ----- OTHER MISSION MANPOWER
110     18
120     918.0 11310 WMMCCS ADF-SAC
130     1335.0 11312 POST ATTACK CMD AND CONTROL SYSTEM
140     395.0 11320 MISSION EVALUATION ACTIVITY (OFFENSIVE)
150     752.0 11330 OPERATIONAL HEADQUARTERS (OFFENSIVE)
160     651.0 11397 TRAINING (OFFENSIVE)
170     3236.0 11398 MST HQ (STRATEGIC OFFENSIVE FORCES)
180     533.0 28030 WPM-AMMUNITION
190     207.0 31011 CRYPTOLOGIC ACTIVITIES
200     1073.0 31021 INTELLIGENCE PRODUCTION ACTIVITIES
210     353.0 31025 INTELLIGENCE DATA HANDLING SYSTEM
220     407.0 31037 SENIOR YEAR OPERATIONS
230     147.0 35157 ADVANCE LOCATION STRIKE SYSTEM (ALSS)
240     266.0 35160 DEFENSE METEOROLOGICAL SATELLITE PROGRAM
250     279.0 41314 OPERATIONAL SUPPORT AIRLIFT
260     945.0 87715 DENTAL CARE ACTIVITIES
270     6026.0 87793 STATION HOSPITALS AND MEDICAL CLINICS
280     1122.0 ----- OTHER SAC
290     25438.0 ----- TENANT MANPOWER
300     9
310     52941.0 MILITARY HOUSING FLOOR SPACE
320     71110.0 NON-HOUSING FLOOR SPACE
330     145.0 MILITARY VEHICLES
331     15.0 B-52 SQUADRONS
332     2.0 FB-111 SQUADRONS
333     21.0 KC-135 SQUADRONS
334     1.0 E-4A SQUADRONS
335     1.0 LGM-25 SQUADRONS
336     6.0 LGM-30 SQUADRONS
340     2
350     18.0 LGM-25 TITAN
360     1000.0 LGM-30 MINUTEMAN
370     14

```

Figure 5.3. Listing of Mission Data File SACOP

380	92.0	32545.0	2224.0	B-52D
390	106.0	47852.0	6496.0	B-52G
400	73.0	36956.0	5207.0	B-52H
410	374.0	108661.0	22443.0	KC-135A
420	50.0	14519.0	3115.0	KC-135D
430	47.0	18085.0	5472.0	FB-111A
440	5.0	1637.0	2183.0	EC-135A
450	13.0	11573.0	1547.0	EC-135C
460	9.0	3709.0	648.0	EC-135G/L
470	3.0	1764.0	435.0	E-4A
480	2.0	903.0	127.0	RC-135U
490	12.0	3441.0	408.0	RC-135V
500	1.0	929.0	459.0	C-135A
510	2.0	972.0	407.0	C-135B
520	22			
530	1 4			
540	38 46.43 39 33.63 40 37.80 30 442.45			
550	2 2			
560	43 42.58 31 442.45			
570	3 5			
580	39 6.11 40 6.11 43 2.20 30 12.25 31 12.25			
590	4 3			
600	32 69.09 41 18.70 42 21.02			
610	5 1			
620	36 57.75			
630	6 2			
640	35 4.00 37 10.46			
650	7 1			
660	47 117.33			
661	8 18			
662	9 1.0 10 1.0 11 1.0 12 1.0 13 1.0 14 1.0			
663	15 1.0 16 1.0 17 1.0 18 1.0 19 1.0 20 1.0			
664	21 1.0 22 1.0 23 1.0 24 1.0 25 1.0 26 1.0			
670	66 1			
680	52 .068			
690	67 1			
700	53 .136			
710	68 1			
720	54 .141			
730	69 1			
740	55 .207			
750	70 1			
760	56 .215			
770	71 1			
780	57 .303			
790	72 1			
800	58 1.334			

Figure 5.3 (Continued)

810	73 1
820	69 .134
830	74 1
840	60 .175
850	75 1
860	61 .247
870	76 1
880	62 .141
890	77 1
900	63 .119
910	78 1
920	64 .494
930	79 1
940	65 .419
950	6
960	38 7
970	30 1984.9 31 2008.3 32 1696.0 33 3919.7 34 975.0 35 1153.3 26 1.169
980	22 1
990	27 1.0
1000	33 1
1010	28 1.0
1020	25 14
1030	52 .33375 53 .33167 54 .277 55 .19417 56 .18167 57 .125 58 .1625
1040	59 .1625 60 .1625 61 .33917 62 .15417 63 .15417 64 .1521 65 .1521
1050	29 1
1060	29 1.0
1070	30 2
1080	36 89.50 37 24.74

Figure 5.3 (Continued)

- Other Mission Capabilities: Lines 310 through 336 contain data on other mission capabilities. The first column in each line indicates FY79 values for each mission capability indicator, while the second column identifies each indicator.
 - Missiles: Lines 350 and 360 provide missile inventory data and are organized similarly, with the first column indicating FY79 numbers of each type of missile, and the second column identifying the missile type.
 - Aircraft: Lines 380 through 510 contain aircraft inventory data. The first column of each line indicates the number of aircraft of each type. The second column indicates total flying hours per aircraft. The third column lists annual number of sorties. The last column identifies the aircraft type.
- It is important to recognize here that data on lines 30 through 510 contained in the five sections just discussed--as well as data in many other data files--are also internally stored by the computer using alternative arrays to facilitate computations. That is:
 - The seven specifically identified PEs on lines 40 through 100, and the aggregation of PE manpower identified on line 101, and their associated data are arrayed internally using row identifying numbers 1 through 8 on an alternative internal computational table used by the computer.
 - The 18 PEs or PE aggregations on lines 120 through 290 are arrayed on that alternative internal table using row numbers 9 through 26.
 - The nine other mission components on lines 310 through 336 use row numbers 27 through 35.
 - The two missile components on lines 350 and 360 use row numbers 36 and 37.

- From lines 380 through 510, the 14 aircraft number values use row numbers 38 through 51, the 14 flying hour values use row numbers 52 through 65, and the 14 sortie values use row numbers 66 through 79.
- Lines 520 through 1080 contain two computational sections, the first for computation of mission/mission relationships, the second for computation of mission/workload relationships.
 - Lines 520 through 940, mission/mission relationships. Line 520 indicates the number of mission/mission equations (22) and lines 530 through 940 contain these relationships. Data for each relationship are contained in at least two lines. The first line of each set contains two pieces of information: the first number is the mission matrix row number, which indicates the mission capability indicator to be modified, and the second number indicates the number of other mission components that produce changes in the given mission indicator. The second line (and, if necessary, succeeding lines) contains the matrix row identifying number of each of these capability components followed by the coefficient by which it is to be multiplied. For example, line 550 indicates that the mission manpower for FB-111 squadrons (row 2) is related to two other mission factors. These factors, and their respective coefficients, are identified in line 560. Thus, the number of FB-111A aircraft (matrix row 43) when multiplied by the coefficient 42.58, and the number of FB-111 squadrons (matrix row 31) when multiplied by the coefficient 442.45, will produce the mission manpower requirements for F-111 squadrons in SAC.
 - Lines 950 through 1080, mission/workload relationships. Line 950 indicates the number of mission/workload relationships (six), while the following lines contain the relationships. These lines are organized similarly to

those describing mission/mission relationships, with each relationship described by at least two lines. In this case, however, the first number of the first line indicates the matrix column number in the manpower and workload data files for SAC (see SACFL file in Appendix E and discussion in Section 5.4) of the particular workload indicator to be related. The second number indicates the number of mission capability indicators producing changes in the given workload indicators, and the second line (and succeeding lines) again contain the matrix row numbers in SACOP of the appropriate mission indicators, each followed by the respective coefficient by which it is to be multiplied.

5.4 DESCRIPTION OF MANPOWER AND WORKLOAD DATA FILES

This section provides a detailed description of the manpower and workload data files using the ATCFL file as an example (other command files are similar and the listings for SACFL and TACFL are presented in detail in Appendix E). Line spacing was provided as we constructed each file to allow data to be interspersed in an orderly fashion at appropriate points as our research progressed. Accordingly, the ATCFL data file appearing in Figure 5.4 and the descriptive summary which follows do not use consecutive data file lines throughout, but allow adequate spacing for possible future use.

- Line 20 contains the constant, 1, and the BOS/RPMA manpower average base opening cost for ATC.
- Line 40 contains the label of the particular command to which the file pertains.
- Line 60 contains a number of parameters used by the linear program. The first number (10) is the number of manpower functions contained in the file. Next comes the number (35) of the variables in the file, including manpower, workload, and slack variables. The number of equations (23) contained

```

LIST ATCFL
 20      1,670.2
 40      AIR TRAINING COMMAND
 60      10. 35. 23.  .04 7. 44. 4. 16.
 80      4555.
100      1160.
120      1683.
140      4911.
160      3064.
180      819.
200      3469.
220      230.
240      569.
260      2763.
280      0.
300      0.
320      0.
340      0.
360      0.
380      0.
400      0.
420      0.
440      0.
460      0.
480      75772.2
490      19587.9
500      77086.2
510      73848.
520      19512.9
530      5902.9
540      37023.
550      45143.1
560      790796.2
570      52859.4
580      52007.8
590      156.
600      22373.
610      0.
620      0.

```

Figure 5.4. Listing of Manpower and Workload Data File ATCFL

660	'V3'	2.96	26.49	60.92	122.4
680	MAINTENANCE & REPAIR OF REAL PROPERTY				
700	'V4'	0.	27.32	69.66	20.7
720	OPERATION OF UTILITIES FOR ALL REAL PROP				
740	'V5'	1.49	32.38	38.32	91.1
760	OTHER ENGINEERING SUPPORT				
780	'V6'	7.10	52.61	39.99	0.
800	ADMINISTRATION				
820	'V7'	3.49	55.03	39.95	165.
840	RETAIL SUPPLY OPERATIONS				
860	'V8'	.36	38.56	34.68	0.
880	MAINTENANCE OF INSTALLATION EQUIPMENT				
900	'V9'	4.27	65.95	17.46	193.
920	OTHER BASE SERVICES				
940	'V10'	.43	44.78	54.79	0.
960	BACHELOR HOUSING OPERATIONS & FURNISH				
980	'V11'	1.88	52.62	45.30	0.
1000	MORALE, WELFARE, & RECREATION				
1020	'V12'	4.63	9.74	4.81	78.
1040	OTHER PERSONNEL SUPPORT				

Figure 5.4 (Continued)

Figure 5.4 (Continued)

Figure 5.4 (Continued)

Figure 5.4 (Continued)

in the file comes next, followed by the value of epsilon (.04) which defines the precision of the linear program. Following this come, respectively: the number (7) of workload indicator variables (other than the population variables), the number of output display lines (44), the number (4) of manpower functions whose values are determined by the workload indicator variables, and the last number in this line (16) which defines the number of equations that are included in the model in either the "mission" or "workload" modes.

- The next 35 lines--lines 80 through 620--contain, in order, the FY79 values for the variables in the model.
 - The first ten of these (lines 80 through 260) represent the values for the ten manpower functions.
 - The next ten lines (280 through 460) are the initial values of the slack variables (all zeroes in this case).
 - The last 15 lines of this group (480 through 620) are the values for the workload variables.
- Lines 660 through 1040 further describe the manpower functions in two-line sets, including: on the first line, the variable name (e.g., "V3"); the percentage manpower makeup of officers, airmen, civilians, and CMYEs (automatically computed as the difference between 100% and the total officer/airmen/civilian percentages) within each function; the base opening cost for that function; and, on the second line, the label that describes the function.
- Lines 1061 through 1086 contain the "heart" of the model including the objective function (line 1061), the equation constants (line 1062), and the equations themselves (lines 1063 through 1086).
 - Each equation line (23 in all for this ATCFL example) contains the coefficients to be used as multipliers of one or more of the 35 FY79 values contained in lines 80 through 620.

- Each column in the matrix represents, in order, one of the 35 variables. Table 5.1 identifies the variable that is associated with each column in the equation matrices found in ATCFL (as well as SACFL and TACFL, both presented in Appendix E). The position of the coefficients within each line indicates which of the variables is to be the multiplicand.
 - The linear program variables and equations must be set up in a specific order for the model to perform all options properly. The first constraint equation must be the total manpower constraint. The manpower workload equations come second. The final group of equations is the workload interrelationships. The first two workload interrelationship equations must be the population interrelationships. These include the relationships between base population and total population supported, and between base population and military population.
 - The variables must be arranged by column in the same order they are specified in lines 80 through 620. That is, manpower functions, followed by manpower slack variables, and concluding with the workload indicators.
- Line 1500 specifies which of the ten manpower functions have values that are determined by the workload indicator variables. The number of functions specified must agree with the number indicated in line 60 (in this case, four, as indicated in the line 60 discussion, above).
 - Lines 1560 through 1860 show the columns in the matrix (lines 1061 through 1086) and the labels of the workload indicators that the user may independently modify.
 - Lines 1880 through 3300, the remainder of the file, specify the equations for remaining indicators (population, supply, etc.), their labels, as well as spacing information for the output display. Lines containing only a single zero (for

TABLE 5.1
GEBOS-M VARIABLE IDENTIFICATIONS FOR THE
LINEAR PROGRAMMING MODULE FILES

Column	File		
	SACFL	TACFL	ATCFL
1	V3	V3	V3
2	V4	V4	V4
3	V5	V5	V5
4	V6	V6	V6
5	V7	V7	V7
6	V8	V8	V8
7	V9	V9	V9
8	V10	V10	V10
9	V11	V11	V11
10	V12	V12	V12
11	V3 Slack	V3 Slack	V3 Slack
12	V4 Slack	V4 Slack	V4 Slack
13	V5 Slack	V5 Slack	V5 Slack
14	V6 Slack	V6 Slack	V6 Slack
15	V7 Slack	V7 Slack	V7 Slack
16	V8 Slack	V8 Slack	V8 Slack
17	V9 Slack	V9 Slack	V9 Slack
18	V10 Slack	V10 Slack	V10 Slack
19	V11 Slack	V11 Slack	V11 Slack
20	V12 Slack	V12 Slack	V12 Slack
21	C2	V2	C2
22	V20	V20	V20
23	C5	C5	V29
24	V29	C3	C7
25	V33	V72	V33
26	C3	C7	V42
27	V72	V73	V91
28	C7	V76	C3
29	V73	Slack	V72
30	V76	V42	V76

TABLE 5.1 (Continued)

<u>Column</u>	<u>File</u>		
	<u>SACFL</u>	<u>TACFL</u>	<u>ATCFL</u>
31	V42	V76	C5
32	Slack	Slack	V73
33	V76M	Slack	V76
34	Slack	Slack	Slack
35	---	Slack	Slack

example, lines 1880, 2220, etc.) indicate that the line to be output will not contain data. On the other hand, lines containing only a single "1" (such as 1980, 2022, etc.) indicate that the line to be output will contain both a label and data. Lines containing a series of numbers (2000, 2024, etc.) specify the linear equations of the various indicators. The numbers are the coefficients by which the variables are to be multiplied. Again, the positions of the coefficients indicate which of the variables is to be the multiplicand. The last (36th) number in each of these lines is the constant of the linear equation.

5.5 DESCRIPTION OF THE LINEAR PROGRAMMING MODULE

Linear programming is used as the computational methodology for solving the various manpower/workload problems in the GEBOS-M model. This section describes the linear programming subroutine.

The linear program can be run from GEBOS-M as a separate option by executing the program SUBLP. Instead of the normal print options, the user enters "199". The actual equations used by the linear program can be listed by printing the data set "BOSTMP". The output of the linear program module is stored in the data set "BOSLST".

The linear programming problem as described in "BOSTMP" has the following format:

- Line 1: Number of variables, number of constraints, epsilon (test for 0)
- Line 2: Objective function
- Line 3: Constraint constants
- Line 4 to end: Constraint variable coefficients

The number of variables in the problem includes slack and surplus variables. The current program can handle up to 50 variables and 25 constraints. Epsilon, a precision factor, provides the "0" test value.

Any value less than epsilon is assumed to be 0. The objective function is stated for a minimization problem. Any objective function can be stated as a minimization problem. For example, the workload maximization problem can be stated as a minimization problem by changing the sign on the cost coefficients. Minimization of a negative quantity is identical to maximizing the positive value of such a quantity.

The constraint constants in line 3 should be non-negative values. Otherwise, the possibility of inconsistent results is very large. The program has been modified so that negative constants are removed by multiplying the appropriate constraint equation by the factor "-1".

The linear programming constraints must be structured in the following order:

- Constraint on total BOS/RPMA manpower
- BOS/RPMA manpower/workload equations
- Workload interrelationships required to solve the mission or workload option
- Additional workload interrelationships required to solve the manpower option

The last category of workload interrelationships is required only when the BOS/RPMA manpower input option is selected. In this case, additional constraints are required involving those workload indicators that are determined in the other options, such as total item records, aviation fuel consumption, miles driven, and floor space. In the GEBOS-M model, relationships were used that associated changes in the variable portions of these workload indicators with base population changes.

There are five subroutines involved in the linear program. They are:

- SUBLP
- MATGEN

- REITA
- RAWIA
- RIVO

The subroutines are listed in Appendix D.

SUBLP is the central program. It solves the set of constraints using the revised simplex method. The first step is the generation of the initial working tableau, using the subroutine MATGEN. The next step is selection of the column with the lowest total price using subroutine REITA. The subroutine RAWIA selects the pivot column in the computations, while the subroutine RIVO performs the actual pivoting operation.

The program can terminate in four ways:

- Unbound solution
- Inconsistency
- Faulty processing
- Optimal solution

In an unbound solution, the binding constraint is missing on one or more variables in the objective function and the model can keep increasing the objective function indefinitely without any restriction. An inconsistency occurs when two of the constraints are found to be in conflict, such as $x > 2$ along with $x < 1$. Faulty processing usually means there are missing constants, variables, or other contradictions with the parameter list. An optimal solution indicates processing was completed normally.

The general form of the output is the objective function total (Z), followed by the values for the model variables, in the order they were specified. If improper processing occurs, the appropriate cause of the problem is identified.

The linear programming module in GEBOS-M uses the Revised Simplex Standard Form II Method. A detailed explanation of this procedure can

be found in Linear Programming.¹ The solution methodology uses a two-phase process. In phase I, artificial variables are added to each of the constraint equations which are then driven to 0. Upon the completion of phase I, the program tests for the feasibility of the solution. If the phase I solution is feasible, the model proceeds to phase II and determines the optimal solution. If an inconsistency occurs, the program lists the values of the variables at that stage, and the values of the artificial variables for the constraints. If an artificial variable is non-zero, there is usually a major inconsistency in that particular equation.

The set of relationships used in GEBOS-M requires additional modification for processing by the linear programming module. At least one of the workload interrelationship equations must be converted into an inequality by adding a slack or surplus variable. If this is properly done, the results will be the same as if a set of equalities had been used. This is necessary because of the solution search methodologies used by all linear programming algorithms. Otherwise, the solution search methodology will detect an inconsistency in the equations. Since the solution methodology searches for the optimum values on the equation boundaries, it will effectively derive a solution that is identical to the set of inequalities derived for the model. However, if there are no suboptimal feasible intermediate solutions, the linear programming procedures will likely complete phase I processing with an inconsistency.

There are several ways to identify which equations need to be modified, or whether additional artificial constraints need to be added to the model. All workload equations can be made into inequalities and selected slack or surplus variables can be dropped until a correct optimal answer is produced. Arbitrary inequalities can be added, if an inconsistent result shows certain workload variables have not entered the solution set at the time inconsistencies have been produced. For example, base population could be constrained to be greater than 50,000,

¹G. Hadley, Linear Programming, Addison-Wesley Publishing Company Inc., 1963.

if it should be 100,000, and had not entered the solution set at the time an inconsistency was produced. Workload constraints can be added one at a time, and the intermediate solution sets noted. The value of epsilon can be reduced to a low value to generate an inconsistency, if a set of equations produces a suboptimal result, to determine which variables have not entered the solution set. Generally speaking, the full set of equations necessary to solve the manpower option is the most difficult to debug. The set of equations used in the mission and workload options is usually relatively easy to modify, since there are fewer workload interrelationship constraints.

SECTION 6

VALIDATION

A number of exercises were performed using the GEBOS-M model to test its validity as an accurate support manpower planning device. These validation exercises were designed to demonstrate that the model accurately estimates incremental changes to BOS/RPMA workload and manpower consistent with primary mission force structure changes. Four principal procedures were employed for determining model validity:

- Internal verification of computational methodology using zero force structure change inputs (baseline verification).
- Validation of model sensitivity by analysis and comparison of results from selected programmed mission changes among the various commands.
- Validation through comparison with historical data.
- Validation through comparison with results generated by the GRC-developed Defense Resource Model (DRM).

6.1 BASELINE VERIFICATION

Internal verification of computational methodology and mission change-driven support manpower and workload production equations was accomplished by entering zero-valued force structure changes and comparing the resulting predicted workload indicator and support manpower values with FY79 values for the given command force structure. This procedure successfully verified computational methodology; given zero-valued mission changes, the model accurately replicates all the workload and manpower data for the FY79 force structure and indicates zero changes for each workload indicator and manpower category. Figures 6.1 through 6.3 contain model output results for the three commands. All computed manpower and workload changes are effectively "0" (less than .01%).

INSTRUCTIONS

MISSION IMPACT GENERALIZED EXPLANATORY
BASE OPERATING SUPPORT MODEL (GEBOS-M)

ENTER COMMANDS (1=ATO, 2=SAC, 3=TAC):

2

ENTER CHANGE OPTION (1=MANPOWER, 2=WORKLOAD, 3=MISSION):

3

ENTER PROMPTING OPTION (1=LONG, 2=SHORT):

1

ENTER MISSION TYPE (1=TYPICAL, 2=OPERATIONAL):

2

AIRCRAFT M/D/S TYPES:

1=B-52D

2=B-52G

3=B-52H

4=KC-135A

5=KC-135Q

6=FB-111A

7=EC-135A

8=EC-135C

9=EC-135G/L

10=E-4A

11=AC-135U

12=AC-135W

13=C-135A

14=C-135B

ENTER THE NUMBER OF AIRCRAFT/FLYING HOUR CHANGES TO BE MADE:

0

MISSILE TYPES:

1=LGM-25 TITAN

2=LGM-30 MINUTEMAN

ENTER THE NUMBER OF MISSILE CHANGES TO BE MADE:

0

Figure 6.1. FY79 Baseline Verification Run for SAC

OTHER MISSION CAPABILITY:

- 1=MMMCDS ADP-SAC
- 2=POST ATTACK CMD AND CONTROL SYSTEM
- 3=MISSION EVALUATION ACTIVITY (OFFENSIVE)
- 4=OPERATIONAL HEADQUARTERS (OFFENSIVE)
- 5=TRAINING (OFFENSIVE)
- 6=MGT HQ (STRATEGIC OFFENSIVE FORCES)
- 7=MM-AMMUNITION
- 8=CRYPTOLOGIC ACTIVITIES
- 9=INTELLIGENCE PRODUCTION ACTIVITIES
- 10=INTELLIGENCE DATA HANDLING SYSTEM
- 11=SENIOR YEAR OPERATIONS
- 12=ADVANCE LOCATION STRIKE SYSTEM (ALSS)
- 13=DEFENSE METEOROLOGICAL SATELLITE PROGRAM
- 14=OPERATIONAL SUPPORT AIRLIFT
- 15=DENTAL CARE ACTIVITIES
- 16=STATION HOSPITALS AND MEDICAL CLINICS
- 17=OTHER SAC
- 18=TENANT MANPOWER
- 19=MILITARY HOUSING FLOOR SPACE
- 20=NON-HOUSING FLOOR SPACE
- 21=MILITARY VEHICLES
- 22=B-52 SQUADRONS
- 23=FB-111 SQUADRONS
- 24=KC-135 SQUADRONS
- 25=E-4A SQUADRONS
- 26=LGM-25 SQUADRONS
- 27=LGM-30 SQUADRONS

ENTER THE NUMBER OF OTHER MISSION CHANGES TO BE MADE:

0

ENTER ZERO PRINT OPTION AS FOLLOWS:

- 1=PRINT ALL CHANGES
- 2=PRINT ONLY NON-ZERO CHANGES

ZERO PRINT OPTION IS:

2

ENTER MANPOWER BREAKOUT PRINT OPTION AS FOLLOWS:

- 1=DISPLAY MILITARY/CIVIL BREAKOUT
- 2=DISPLAY TOTAL MANPOWER ONLY

MANPOWER BREAKOUT PRINT OPTION IS:

2

Figure 6.1 (Continued)

STRATEGIC AIR COMMAND

OPERATIONAL MISSION CAPABILITY

AIRCRAFT CAPABILITY

AIRCRAFT INVENTORY:

M/D/S	FY79 AIRCRAFT	CHANGE	RESULTANT AIRCRAFT	PERCENT CHANGE
TOTAL	789.0	0.	789.0	0.

FLYING HOURS:

M/D/S	FY79 FLY HRS	CHANGE	RESULTANT FLY HRS	PERCENT CHANGE
TOTAL	283546.0	0.	283546.0	0.

SORTIES:

M/D/S	FY79 SORTIES	CHANGE	RESULTANT SORTIES	PERCENT CHANGE
TOTAL	51171.0	0.	51171.0	0.

MISSILE CAPABILITY

MISSILE INVENTORY:

M/D/S	FY79 MISSILES	CHANGE	RESULTANT MISSILES	PERCENT CHANGE
TOTAL	1018.0	0.	1018.0	0.

Figure 6.1 (Continued)

OTHER MISSION CAPABILITY				
	FY79 QUANTITY	CHANGE	RESULTANT QUANTITY	PERCENT CHANGE
TOTAL	168975.0	0.	168975.0	0.
MISSION MANPOWER				
	FY79 MISSION MP	CHANGE	RESULTANT MISSION MP	PERCENT CHANGE
TOTAL	90997.0	0.	90997.0	0.

Figure 6.1 (Continued)

STRATEGIC AIR COMMAND

OUTPUT/WORKLOAD				
WORKLOAD INDICATOR	FY79 INDICATOR	CHANGE	RESULTANT INDICATOR	PERCENT CHANGE
POPULATION INDICATORS				
TOTAL BASE POPULATION	132349.4	- .0	132349.4	- .0
TOTAL BASE MISSION POPULATION	90997.4	- .0	90997.4	- .0
TOTAL BASE MILITARY POPULATION	109546.0	- .4	109545.6	- .0
TOTAL BASE CIVILIAN POPULATION	22803.4	.4	22803.8	.0
TOTAL BASE AIRMEN POPULATION	91251.8	- .4	91251.5	- .0
TOTAL BAM MANPOWER	13089.0	- .0	13089.0	- .0
TOTAL BOS MANPOWER	28263.0	.0	28263.0	.0
REAL PROPERTY MAINTENANCE				
MILITARY FAMILY HOUSING FLOOR SPACE	52939.8	0.	52939.8	0.
MILITARY FAMILY HOUSING UNITS	21039.2	0.	21039.2	0.
NON-HOUSING FLOOR SPACE	71110.0	0.	71110.0	0.
UTILITIES				
TOTAL ENERGY CONSUMPTION	23275.7	0.	23275.7	0.
TOTAL ELECTRICITY CONSUMPTION	1718984.7	0.	1718984.7	0.
ADMINISTRATION				
TRAVEL TRANSACTIONS	106177.4	- .0	106177.4	- .0
TOTAL BOS BUDGET	664715.1	.9	664716.0	.0
TRANSACTIONS AUDITED	509214.6	1.4	509216.0	.0
TOTAL AIR FORCE MEMBERS SERVICED	23177.7	.0	23177.7	.0
CIVILIAN PAY ACCOUNTS	21135.7	.4	21136.1	.0
COMMERCIAL SERVICES TRANSACTIONS	81402.2	- .0	81402.2	- .0
MATERIEL TRANSACTION WORKLOAD	23968.0	- .0	23968.0	- .0
SUPPLY				
TOTAL TRANSACTIONS	1562249.3	1.8	1562251.1	.0
SUPPLY TRANSACTIONS	1373064.6	1.8	1373066.2	.0
EQUIPMENT TRANSACTIONS	189184.7	.2	189184.9	.0
TOTAL ITEM RECORDS	174723.1	0.	174723.1	0.
SUPPLY ITEM RECORDS	147920.6	0.	147920.6	0.
EQUIPMENT ITEM RECORDS	26802.5	0.	26802.5	0.
AVIATION FUEL CONSUMPTION	73087.3	0.	73087.3	0.
MAINTENANCE OF INSTALLATION EQUIPMENT				
MILES DRIVEN	91220.2	- .1	91220.1	- .0
VEHICLE EQUIVALENTS	34395.0	.0	34395.0	.0
TOTAL VEHICLES	16044.0	.0	16044.0	.0
MILITARY VEHICLES	145.0	0.	145.0	0.
NON-MILITARY VEHICLES	15899.0	.0	15899.0	.0
BACHELOR HOUSING				
VISITING AIRMEN BEDS	1751.0	- .0	1751.0	- .0
OTHER PERSONNEL SUPPORT				
WEIGHTED RATINGS	424452.0	.7	424452.7	.0

Figure 6.1 (Continued)

FUNCTIONAL MANPOWER (TOTAL)

FUNCTION	FY79 MANPOWER	CHANGE	RESULTANT MANPOWER	PERCENT CHANGE
MAINTENANCE & REPAIR OF REAL PROPERTY	8448.0	- .0	8448.0	- .00
OPERATION OF UTILITIES FOR ALL REAL PROP	1884.0	- .0	1884.0	- .00
OTHER ENGINEERING SUPPORT	2757.0	.0	2757.0	.00
ADMINISTRATION	7104.0	.0	7104.0	.00
RETAIL SUPPLY OPERATIONS	7753.0	.0	7753.0	.00
MAINTENANCE OF INSTALLATION EQUIPMENT	2232.0	.0	2232.0	.00
OTHER BASE SERVICES	7463.0	.0	7463.0	.00
BACHELOR HOUSING OPERATIONS & FURNISHING	324.0	.0	324.0	.00
MORALE, WELFARE, & RECREATION	906.0	- .0	906.0	- .00
OTHER PERSONNEL SUPPORT	2481.0	- .0	2481.0	- .00
TOTAL	41352.0	- .0	41352.0	- .00

MANPOWER SLACK VARIABLES

FUNCTION	SLACK
MAINTENANCE & REPAIR OF REAL PROPERTY	0.
OPERATION OF UTILITIES FOR ALL REAL PROP	0.
OTHER ENGINEERING SUPPORT	0.
ADMINISTRATION	0.
RETAIL SUPPLY OPERATIONS	0.
MAINTENANCE OF INSTALLATION EQUIPMENT	0.
OTHER BASE SERVICES	0.
BACHELOR HOUSING OPERATIONS & FURNISHING	0.
MORALE, WELFARE, & RECREATION	0.
OTHER PERSONNEL SUPPORT	0.

ENTER ITERATION OPTION AS FOLLOWS:
 1=ACCUMULATE CHANGES, 2=BEGIN NEW CYCLE, 3=STOP
 NOTE--ACCUMULATION CHANGES CANNOT BE
 MADE IN THE WORKLOAD OR MISSION MODE
 ITERATION OPTION=

3
 STOP RUN COMPLETE
 CPU/S:9.7

Figure 6.1 (Continued)

.....

MISSION IMPACT GENERALIZED EXPLANATORY
BASE OPERATING SUPPORT MODEL (GEBOS-M)

.....

ENTER COMMANDS (1=ATC, 2=SAC, 3=TAC):
3

ENTER CHANGE OPTION (1=MANPOWER, 2=WORKLOAD, 3=MISSION):
3

ENTER PROMPTING OPTION (1=LONG, 2=SHORT):
1

ENTER MISSION TYPE (1=TYPICAL, 2=OPERATIONAL):
2

AIRCRAFT M/D/S TYPES:

- 1=A-7D
- 2=A-10A
- 3=F-4C
- 4=F-4D
- 5=F-4E
- 6=F-15A
- 7=F-15B
- 8=F-104G
- 9=F-105F/G
- 10=F-111A/D
- 11=RF-4C
- 12=AC-130H
- 13=O-2A
- 14=OV-10A
- 15=EC-135P
- 16=UH-1N/P
- 17=CH-53
- 18=CH-53
- 19=T-38A
- 20=T-38B
- 21=F-5E
- 22=MC-130E

ENTER THE NUMBER OF AIRCRAFT/FLYING HOUR CHANGES TO BE MADE:
0

Figure 6.2. FY79 Baseline Verification Run for TAC

OTHER MISSION CAPABILITY:

- 1=OPERATIONAL HEADQUARTERS (TAF)
- 2=SPECIAL OPERATIONS FORCE
- 3=TACTICAL AIR CONTROL SYSTEM COMMAND
- 4=TACTICAL FIGHTER WEAPONS CENTER RANGE
- 5=CIVIL ENGINEER SQUADRONS (HV REPAIR)
- 6=TACTICAL AIR INTELLIGENCE SYS ACTIVITIES
- 7=TRAINING-TACTICAL AIR FORCES
- 8=MGT HQ (TACTICAL AIR FORCES)
- 9=COMBAT DEVELOPMENTS
- 10=WRM-EQUIPMENT/SECONDARY ITEMS
- 11=CARE IN REGIONAL DEFENSE FACILITIES
- 12=DENTAL CARE ACTIVITIES
- 13=STATION HOSPITALS AND MEDICAL CLINICS
- 14=OTHER TAC
- 15=TENANT MANPOWER
- 16=MILITARY HOUSING FLOOR SPACE
- 17=NON-HOUSING FLOOR SPACE
- 18=MILITARY VEHICLES
- 19=A-7 SQUADRONS
- 20=A-10 SQUADRONS
- 21=F-4 SQUADRONS
- 22=RF-4 SQUADRONS
- 23=F-15 SQUADRONS
- 24=F-105 SQUADRONS
- 25=F-5 SQUADRONS
- 26=F-111 SQUADRONS

ENTER THE NUMBER OF OTHER MISSION CHANGES TO BE MADE:

0

ENTER ZERO PRINT OPTION AS FOLLOWS:

- 1=PRINT ALL CHANGES
- 2=PRINT ONLY NON-ZERO CHANGES

ZERO PRINT OPTION IS:

8

ENTER MANPOWER BREAKOUT PRINT OPTION AS FOLLOWS:

- 1=DISPLAY MILITARY/CIVIL BREAKOUT
- 2=DISPLAY TOTAL MANPOWER ONLY

MANPOWER BREAKOUT PRINT OPTION IS:

2

Figure 6.2 (Continued)

TACTICAL AIR COMMAND

OPERATIONAL MISSION CAPABILITY

AIRCRAFT CAPABILITY

AIRCRAFT INVENTORY:

M/D/S	FY79 AIRCRAFT	CHANGE	RESULTANT AIRCRAFT	PERCENT CHANGE
TOTAL	1683.0	0.	1683.0	0.

FLYING HOURS:

M/D/S	FY79 FLY HRS	CHANGE	RESULTANT FLY HRS	PERCENT CHANGE
TOTAL	479616.0	0.	479616.0	0.

SORTIES:

M/D/S	FY79 SORTIES	CHANGE	RESULTANT SORTIES	PERCENT CHANGE
TOTAL	332811.0	0.	332811.0	0.

OTHER MISSION CAPABILITY

	FY79 QUANTITY	CHANGE	RESULTANT QUANTITY	PERCENT CHANGE
TOTAL	111316.0	0.	111316.0	0.

MISSION MANPOWER

	FY79 MISSION MP	CHANGE	RESULTANT MISSION MP	PERCENT CHANGE
TOTAL	72904.0	0.	72904.0	0.

Figure 6.2 (Continued)

TACTICAL AIR COMMAND

OUTPUT/WORKLOAD				
WORKLOAD INDICATOR	FY79 INDICATOR	CHANGE	RESULTANT INDICATOR	PERCENT CHANGE
POPULATION INDICATORS				
TOTAL BASE POPULATION	100435.6	.0	100435.6	.0
TOTAL BASE MISSION POPULATION	72903.6	-.0	72903.6	-.0
TOTAL BASE MILITARY POPULATION	83763.3	-.0	83763.3	-.0
TOTAL BASE CIVILIAN POPULATION	16672.3	.0	16672.3	.0
TOTAL BASE AIRMEN POPULATION	72153.7	-.0	72153.7	-.0
TOTAL RPM MANPOWER	8599.0	-.0	8599.0	-.0
TOTAL BOS MANPOWER	18933.0	.0	18933.0	.0
REAL PROPERTY MAINTENANCE				
MILITARY FAMILY HOUSING FLOOR SPACE	27019.2	0.	27019.2	0.
MILITARY FAMILY HOUSING UNITS	10557.1	0.	10557.1	0.
NON-HOUSING FLOOR SPACE	39628.0	0.	39628.0	0.
UTILITIES				
TOTAL ENERGY CONSUMPTION	8125.0	0.	8125.0	0.
TOTAL ELECTRICITY CONSUMPTION	1040039.0	0.	1040039.0	0.
ADMINISTRATION				
TRAVEL TRANSACTIONS	82092.0	-.6	82091.4	-.0
TOTAL BOS BUDGET	585587.1	-.4	585586.7	-.0
TRANSACTIONS AUDITED	401390.7	.0	401390.7	.0
TOTAL AIR FORCE MEMBERS SERVICED	93593.6	.0	93593.6	.0
CIVILIAN PAY ACCOUNTS	15241.9	.0	15241.9	.0
COMMERCIAL SERVICES TRANSACTIONS	71090.9	.0	71090.9	.0
MATERIEL TRANSACTION WORKLOAD	18633.9	.0	18633.9	.0
SUPPLY				
TOTAL TRANSACTIONS	1581873.5	-1.7	1581871.8	-.0
SUPPLY TRANSACTIONS	1383893.8	-1.5	1383892.1	-.0
EQUIPMENT TRANSACTIONS	197980.8	-.2	197980.6	-.0
TOTAL ITEM RECORDS	151017.8	0.	151017.8	0.
SUPPLY ITEM RECORDS	131476.1	0.	131476.1	0.
EQUIPMENT ITEM RECORDS	19541.7	0.	19541.7	0.
AVIATION FUEL	54731.0	0.	54731.0	0.
MAINTENANCE OF INSTALLATION EQUIPMENT				
MILES DRIVEN	37167.0	0.	37167.0	0.
VEHICLE EQUIVALENTS	19413.0	.1	19413.1	.0
TOTAL VEHICLES	8295.0	.0	8295.0	.0
MILITARY VEHICLES	497.0	0.	497.0	0.
NON-MILITARY VEHICLES	8798.0	.0	8798.0	.0
BACHELOR HOUSING				
VISITING AIRMEN BEDS	1663.0	.3	1663.3	.0
OTHER PERSONNEL SUPPORT				
WEIGHTED RATIONS	334274.5	-.1	334274.4	-.0

Figure 6.2 (Continued)

FUNCTIONAL MANPOWER (TOTAL)

FUNCTION	FY79 MANPOWER	CHANGE	RESULTANT MANPOWER	PERCENT CHANGE
MAINTENANCE & REPAIR OF REAL PROPERTY	5422.0	- .0	5422.0	- .00
OPERATION OF UTILITIES FOR ALL REAL PROP	1088.0	- .0	1088.0	- .00
OTHER ENGINEERING SUPPORT	2089.0	.0	2089.0	.00
ADMINISTRATION	4648.0	- .0	4648.0	- .00
RETAIL SUPPLY OPERATIONS	5910.0	- .0	5910.0	- .00
MAINTENANCE OF INSTALLATION EQUIPMENT	1082.0	.0	1082.0	.00
OTHER BASE SERVICES	4582.0	- .0	4582.0	- .00
BACHELOR HOUSING OPERATIONS & FURNISHING	207.0	.0	207.0	.00
MORALE, WELFARE, & RECREATION	642.0	.0	642.0	.00
OTHER PERSONNEL SUPPORT	1862.0	.0	1862.0	.00
TOTAL	27532.0	.0	27532.0	.00

MANPOWER SLACK VARIABLES

FUNCTION	SLACK
MAINTENANCE & REPAIR OF REAL PROPERTY	0.
OPERATION OF UTILITIES FOR ALL REAL PROP	0.
OTHER ENGINEERING SUPPORT	0.
ADMINISTRATION	0.
RETAIL SUPPLY OPERATIONS	0.
MAINTENANCE OF INSTALLATION EQUIPMENT	0.
OTHER BASE SERVICES	0.
BACHELOR HOUSING OPERATIONS & FURNISHING	0.
MORALE, WELFARE, & RECREATION	0.
OTHER PERSONNEL SUPPORT	0.

ENTER ITERATION OPTION AS FOLLOWS:
 1=ACCUMULATE CHANGES, 2=BEGIN NEW CYCLE, 3=STOP
 NOTE--ACCUMULATION CHANGES CANNOT BE
 MADE IN THE WORKLOAD OR MISSION MODE
 ITERATION OPTION=
 3
 STOP RUN COMPLETE
 FUNC: 9.2

Figure 6.2 (Continued)

.....

MISSION IMPACT GENERALIZED EXPLANATORY
BASE OPERATING SUPPORT MODEL (GEIOS-M)

.....

ENTER COMMANDS (1=ATC,2=SAC,3=TAC):
1

ENTER CHANGE OPTION (1=MANPOWER,2=WORKLOAD,3=MISSION):
3

ENTER PROMPTING OPTION (1=LONG, 2=SHORT)
1

ENTER MISSION TYPE (1=TYPICAL, 2=OPERATIONAL):
2

AIRCRAFT M/D/S TYPES:
1= T-37B
2= T-38A
3= T-41A/C
4= T-43A

ENTER THE NUMBER OF AIRCRAFT/FLYING HOUR CHANGES TO BE MADE:
0

OTHER MISSION CAPABILITY:
1=OTHER PROFESSIONAL EDUCATION
2=SUPPORT OF TRAINING ESTABLISHMENT
3=MANAGEMENT HEADQUARTERS (TRAINING)
4=EDUCATION/TRAINING (HEALTH CARE)
5=CARE IN REGIONAL DEFENSE FACILITIES
6=DENTAL CARE ACTIVITIES
7=STATION HOSPITALS AND MEDICAL CLINICS
8=OTHER PERSONNEL ACTIVITIES
9=OTHER ATC MANPOWER
10=TENANT MANPOWER
11=RECRUIT TRAINING WORKLOAD
12=TECHNICIAN TRAINING WORKLOAD
13=CRYPTO/INTELLIGENCE TRAINING WORKLOAD
14=PILOT TRAINING WORKLOAD
15=NAVIGATOR TRAINING WORKLOAD
16=CADET TRAINING WORKLOAD
17=PROFESSIONAL EDUCATION TRAINING WORKLOAD
18=MILITARY HOUSING FLOOR SPACE
19=NON-HOUSING FLOOR SPACE
20=MILITARY VEHICLES
21=FLIGHT TRAINING SQUADRONS

Figure 6.3. FY79 Baseline Verification Run for ATC

ENTER THE NUMBER OF OTHER MISSION CHANGES TO BE MADE:

0

ENTER ZERO PRINT OPTION AS FOLLOWS:

1=PRINT ALL CHANGES

2=PRINT ONLY NON-ZERO CHANGES

ZERO PRINT OPTION IS:

2

ENTER MANPOWER BREAKOUT PRINT OPTION AS FOLLOWS:

1=DISPLAY MILITARY/CIVIL BREAKOUT

2=DISPLAY TOTAL MANPOWER ONLY

MANPOWER BREAKOUT PRINT OPTION IS:

2

Figure 6.3 (Continued)

AIR TRAINING COMMAND

OPERATIONAL MISSION CAPABILITY

AIRCRAFT CAPABILITY

AIRCRAFT INVENTORY:

M/D/S	FY79 AIRCRAFT	CHANGE	RESULTANT AIRCRAFT	PERCENT CHANGE
TOTAL	1168.0	0.	1168.0	0.

FLYING HOURS:

M/D/S	FY79 FLY HRS	CHANGE	RESULTANT FLY HRS	PERCENT CHANGE
TOTAL	610578.0	0.	610578.0	0.

SORTIES:

M/D/S	FY79 SORTIES	CHANGE	RESULTANT SORTIES	PERCENT CHANGE
TOTAL	484815.0	0.	484815.0	0.

OTHER MISSION CAPABILITY

	FY79 QUANTITY	CHANGE	RESULTANT QUANTITY	PERCENT CHANGE
TOTAL	150133.0	0.	150133.0	0.

MISSION MANPOWER

	FY79 MISSN MP	CHANGE	RESULTANT MISSN MP	PERCENT CHANGE
TOTAL	52549.0	0.	52549.0	0.

Figure 6.3 (Continued)

AIR TRAINING COMMAND

OUTPUT/WORKLOAD

WORKLOAD INDICATOR	FY79 INDICATOR	CHANGE	RESULTANT INDICATOR	PERCENT CHANGE
POPULATION				
TOTAL BASE POPULATION	75772.2	.0	75772.2	.0
TOTAL BASE MISSION POPULATION	52549.2	-.0	52549.2	-.0
TOTAL BASE MILITARY POPULATION	45143.1	.0	45143.1	.0
TOTAL BASE CIVILIAN POPULATION	30629.1	-.0	30629.1	-.0
TOTAL BASE AIRMEN POPULATION	34498.4	.0	34498.4	.0
TOTAL RPMA MANPOWER	7398.0	-.0	7398.0	-.0
TOTAL BOS MANPOWER	15825.0	.0	15825.0	.0
TOTAL STUDENTS AUTHORIZED	37023.0	0.	37023.0	0.
MISSION POPULATION	52549.2	-.0	52549.2	-.0
REAL PROPERTY MAINTENANCE				
MILITARY FAMILY HOUSING UNITS	7911.0	0.	7911.0	0.
MILITARY FAMILY HOUSING FLOOR SPACE	19587.9	0.	19587.9	0.
NON-HOUSING FLOOR SPACE	52007.8	0.	52007.8	0.
UTILITIES				
TOTAL ENERGY CONSUMPTION	12529.2	0.	12529.2	0.
TOTAL ELECTRICITY CONSUMPTION	940104.9	0.	940104.9	0.
ADMINISTRATION				
TRAVEL TRANSACTIONS	77086.2	.0	77086.2	.0
TOTAL BOS BUDGET	491787.0	.5	491787.5	.0
TRANSACTIONS AUDITED	362177.0	.6	362177.6	.0
TOTAL AIR FORCE MEMBERS SERVICED	74183.3	.0	74183.3	.0
CIVILIAN PAY ACCOUNTS	24772.0	.1	24772.1	.0
COMMERCIAL SERVICE TRANSACTIONS	63190.0	.1	63190.1	.0
MATERIEL TRANSACTION WORKLOAD	14947.0	.0	14947.0	.0
SUPPLY				
TOTAL TRANSACTIONS	694115.0	-.6	694114.4	-.0
SUPPLY TRANSACTIONS	621927.8	-.5	621927.3	-.0
EQUIPMENT TRANSACTIONS	72187.2	-.1	72187.1	-.0
TOTAL ITEM RECORDS	73848.0	0.	73848.0	0.
SUPPLY ITEM RECORDS	62047.1	0.	62047.1	0.
EQUIPMENT ITEM RECORDS	11800.9	0.	11800.9	0.
AVIATION FUEL	19512.9	0.	19512.9	0.
MAINTENANCE OF INSTALLATION EQUIPMENT				
MILES DRIVEN	22373.0	.0	22373.0	.0
TOTAL VEHICLES	4695.0	.0	4695.0	.0
MILITARY VEHICLES	156.0	0.	156.0	0.
NON-MILITARY VEHICLES	4539.0	.0	4539.0	.0
BACHELOR HOUSING				
DORMITORY BEDS	58632.0	0.	58632.0	0.
VISITING AIRMEN BEDS	1357.0	-.0	1357.0	-.0
VISITING AIRMEN FLOOR SPACE	5902.9	-.0	5902.9	-.0
OTHER PERSONNEL SUPPORT				
WEIGHTED RATIONS	790796.2	0.	790796.2	0.

Figure 6.3 (Continued)

FUNCTIONAL MANPOWER (TOTAL)

FUNCTION	FY79 MANPOWER	CHANGE	RESULTANT MANPOWER	PERCENT CHANGE
MAINTENANCE & REPAIR OF REAL PROPERTY	4555.0	- .0	4555.0	- .00
OPERATION OF UTILITIES FOR ALL REAL PROP	1160.0	- .0	1160.0	- .00
OTHER ENGINEERING SUPPORT	1683.0	- .0	1683.0	- .00
ADMINISTRATION	4911.0	. 0	4911.0	. 00
RETAIL SUPPLY OPERATIONS	3064.0	- .0	3064.0	- .00
MAINTENANCE OF INSTALLATION EQUIPMENT	819.0	. 0	819.0	. 00
OTHER BASE SERVICES	3469.0	. 0	3469.0	. 00
BACHELOR HOUSING OPERATIONS & FURNISH	230.0	. 0	230.0	. 00
MORALE, WELFARE, & RECREATION	569.0	. 0	569.0	. 00
OTHER PERSONNEL SUPPORT	2763.0	. 0	2763.0	. 00
TOTAL	23223.0	. 0	23223.0	. 00

MANPOWER SLACK VARIABLES

FUNCTION	SLACK
MAINTENANCE & REPAIR OF REAL PROPERTY	0.
OPERATION OF UTILITIES FOR ALL REAL PROP	0.
OTHER ENGINEERING SUPPORT	0.
ADMINISTRATION	0.
RETAIL SUPPLY OPERATIONS	0.
MAINTENANCE OF INSTALLATION EQUIPMENT	0.
OTHER BASE SERVICES	0.
BACHELOR HOUSING OPERATIONS & FURNISH	0.
MORALE, WELFARE, & RECREATION	0.
OTHER PERSONNEL SUPPORT	0.

ENTER ITERATION OPTION AS FOLLOWS:
 1=ACCUMULATE CHANGES, 2=BEGIN NEW CYCLE, 3=STOP
 NOTE--ACCUMULATION CHANGES CANNOT BE
 MADE IN THE WORKLOAD OR MISSION MODE
 ITERATION OPTION=

2
 STOP RUN COMPLETE

Figure 6.3 (Continued)

6.2 MODEL SENSITIVITY

Model sensitivity was tested by examining model predictions of support workload and manpower for various programmed force structure changes. In aggregate, over 50 varied changes were tested. For SAC, TAC, and ATC, model predictions based upon addition of various aircraft squadrons were examined. These were later compared to manpower and workload predictions for the same aircraft changes when made to existing squadrons. These comparisons confirmed model capability to distinguish between differently structured mission changes involving identical aircraft numbers and M/D/S. Various additional non-aircraft mission changes were made to ATC and the model results analyzed. Finally, this phase of validation included analysis of changes to unspecified mission population, average tenant manpower and other command manpower, and the corresponding model predictions.

Tables 6.1 through 6.3 identify changes to selected workload indicators and functional BOS/RPMA manpower categories predicted by the model based upon specified mission changes which include the addition of new squadrons.

For all three commands, significant variations were observed in the values of workload indicator and functional manpower changes among the various force structure changes. Thus, for example, the model predicts for SAC a 1290.2 increase in base population for an addition of 14 B-52Ds, with an increase of only 429.7 for an addition of 15 KC-135As. Total BOS/RPMA manpower support varied similarly: the B-52 force change required a support manpower increase of 185.5, compared to the 80.1 support manpower increase required by the addition of the KC-135s. The model also predicted significant variation in BOS manpower as a percent of mission population. These values ranged from a low of 13.5% predicted for addition of an FB-111A squadron to a high of 21% predicted for the KC-135 force change.

In addition to these intra-command variations, GEBOS-M predicted significant variation in workload and manpower changes among commands, based upon the types of force structure changes entered in each. Thus,

SAC MISSION CHANGES - ADDITIONS OF NEW SQUADRONS

	Mission Changes						
Aircraft Type	B-52D	B-52G	B-52H	KC-135A	KC-135Q	FB-111A	
Number of Aircraft	14	14	17	15	30	13	
Flying Hours/Aircraft	420	420	408	300	312	288	
Missile Type							LGM-25 Titan
							LGM-30 Minuteman
Number of Missiles							9 50
	Workload Changes						
Base Population	1290.2	1185.7	1397.1	429.7	830.6	1195.2	606.2 623.0
Mission Population	1104.7	1011.1	1201.2	349.6	699.7	1036.8	519.7 527.0
Military Population	1067.5	981.0	1156.0	355.2	687.1	988.9	501.3 515.3
Military Family Housing Floor Space	0	0	0	0	0	0	0 0
Non-Housing Floor Space	0	0	0	0	0	0	0 0
Travel Transactions	1333.2	1225.2	1443.6	444.0	858.3	1235.0	626.4 643.8
Total Item Records	1984.9	1984.9	1984.9	1696.0	1696.0	2008.3	975.0 1153.3
Aviation Fuel Consumption	1962.4	1950.2	1921.3	873.8	1700.4	468.0	0 0
Miles Driven	242.9	223.2	263.0	80.9	156.4	225.0	919.6 1354.3
Military Vehicles	0	0	0	0	0	0	0 0
Visiting Airmen Beds	4.2	3.8	4.5	1.4	2.7	3.9	2.0 2.0
Weighted Rations Served	2764.1	2540.3	2993.1	921.1	1779.8	2560.6	1299.1 1335.1

TABLE 6.1 (Continued)

	B-52D	B-52G	B-52H	KC-135A	KC-135Q	FB-111A	Titan	Minuteman
	<u>Manpower Changes</u>							
Maintenance and Repair of Real Property	10.1	9.3	10.9	3.4	6.5	9.4	4.7	4.9
Operation of Utilities for All Real Property	0	0	0	0	0	0	0	0
Other Engineering Support	9.8	9.0	10.6	3.3	6.3	9.0	4.6	4.7
Administration	58.4	53.7	63.2	19.5	37.6	54.1	27.5	28.2
Retail Supply Operations	53.5	53.3	53.0	36.2	46.0	36.1	14.8	17.5
Maintenance of Installation Equipment	2.9	2.7	3.1	1.0	1.9	2.7	11.0	16.2
Other Base Services	35.0	32.2	37.9	11.7	22.5	32.4	16.5	16.9
Bachelor Housing Operations and Furnishing	0	0	0	0	0	0	0	0
Morale, Welfare, and Recreation	3.3	3.0	3.5	1.1	2.1	3.0	1.5	1.6
Other Personnel Support	12.5	11.5	13.6	4.2	8.1	11.6	5.9	6.0
Total	185.5	174.6	195.9	80.1	131.0	158.4	86.4	96.0
Total RPMA Manpower	19.9	18.3	21.5	6.6	12.8	18.4	9.3	9.6
% of Mission Population	1.8	1.8	1.8	1.9	1.8	1.8	1.8	1.8
Total BOS Manpower	165.6	156.4	174.4	73.5	118.2	140.0	77.1	86.4
% of Mission Population	15.0	15.5	14.5	21.0	16.9	13.5	14.8	16.4

TABLE 6.2
TAC MISSION CHANGES - ADDITIONS OF NEW SQUADRONS

Aircraft Type	<u>Mission Changes</u>					
	<u>A-7D</u>	<u>A-10A</u>	<u>F-4D</u>	<u>F-15A</u>	<u>F-111A/D</u>	<u>RF-4C</u>
Number of Aircraft	24	18	18	18	18	18
Flying Hours/Aircraft	320	368	240	244	240	264
	<u>Workload Changes</u>					
Base Population	905.4	714.7	898.6	1284.8	998.0	868.6
Mission Population	811.6	640.2	783.3	1094.9	781.8	716.3
Military Population	755.1	596.0	749.4	1071.5	832.3	724.4
Military Family Housing Floor Space	0	0	0	0	0	0
Non-Housing Floor Space	0	0	0	0	0	0
Travel Transactions	2223.1	1754.7	2206.5	3155.0	2450.6	2132.8
Total Item Records	0	400.5	1398.5	3054.6	1544.0	2990.8
Aviation Fuel Consumption	438.5	284.3	552.5	510.8	540.0	528.9
Miles Driven	261.1	194.1	192.2	183.1	103.7	166.3
Military Vehicles	0	0	0	0	0	0
Visiting Airmen Beds	15.6	12.4	15.4	21.9	17.1	14.9
Weighted Rations Served	2220.1	1752.4	2203.5	3150.5	2447.2	2129.9
	<u>Manpower Changes</u>					
Maintenance and Repair of Real Property	14.3	11.3	14.2	20.3	15.8	13.8
Operation of Utilities for All Real Property	0	0	0	0	0	0
Other Engineering Support	2.5	1.9	2.4	3.5	2.7	2.4
Administration	11.9	9.4	11.8	16.9	13.1	11.4
Retail Supply Operations	11.9	10.0	35.1	76.6	38.7	75.0
Maintenance of Instal- lation Equipment	4.0	3.0	3.0	2.8	1.6	2.6
Other Base Services	31.5	24.9	31.3	44.7	34.7	30.2

TABLE 6.2 (Continued)

Manpower Changes (Continued)	A-7D	A-10A	F-4D	F-15A	F-111A/D	RF-4C
Bachelor Housing Operations and Furnishing	0.3	0.2	0.3	0.4	0.3	0.3
Morale, Welfare, and Recreation	1.2	1.0	1.2	1.7	1.4	1.2
Other Personnel Support	16.1	12.7	16.0	22.8	17.8	15.5
Total	93.8	74.5	115.3	189.9	126.1	152.3
Total RPMA Manpower	16.8	13.3	16.7	23.8	18.5	16.1
% of Mission Population	2.1	2.1	2.1	2.2	2.1	2.2
Total BOS Manpower	77.0	61.2	98.6	166.1	107.6	136.2
% of Mission Population	9.5	9.6	12.6	15.2	12.3	19.0

TABLE 6.3

ATC MISSION CHANGES - ADDITIONS OF NEW SQUADRONS

Aircraft Type	Mission Changes						
	T-37B	T-38A	T-43A				
				Recruit	Tech- nician	Crypto/ Intelli- gence	Cadet
Number of Aircraft	35	35	12				
Flying Hours/Aircraft	580	530	800				
Type of Training							Professional Education
Number of Students	Workload Changes						
	1000	1000	1000	1000	1000	1000	1000
Base Population	177.4	182.2	576.5	280.5	573.8	1,771.6	1,204.8
Mission Population	133.7	133.7	442.6	186.5	451.0	1,531.0	1,020.0
Military Population	105.7	108.5	343.5	167.1	341.9	1,055.5	717.8
Students Authorized	75.6	75.6	762.0	1,000.0	1,000.0	1,000.0	1,000.0
Military Family Hous- ing Floor Space	0	0	0	0	0	0	0
Non-Housing Floor Space	0	0	0	0	0	0	0
Travel Transactions	185.7	190.7	603.5	293.6	600.7	1,854.5	1,261.2
Total Item Records	1,379.4	1,379.4	1,701.3	468.9	468.9	468.9	468.9
Aviation Fuel Consumption	304.5	602.9	679.7	0	0	0	0
Miles Driven	38.4	39.4	124.6	60.6	124.0	382.7	260.3
Military Vehicles	0	0	0	0	0	0	0
Visiting Airmen Beds	3.9	4.0	12.8	6.2	12.7	39.3	26.7
Weighted Rations Served	1,675.4	1,675.4	16,885.9	22,160.0	22,160.0	22,160.0	22,160.0

TABLE 6.3 (Continued)

	T-37B	T-38A	T-43A	<u>Manpower Changes</u>				Tech- nician	Crypto/ Intelli- gence	Cadet	Professional Education
Maintenance and Repair of Real Property	0	0	0	0	0	0	0	0	0	0	0
Operation of Utilities for all Real Property	0.7	0.7	2.2	1.1	2.2	6.8	4.6	4.1			
Other Engineering Support	0	0	0	0	0	0	0	0			
Administration	7.7	7.9	25.1	12.2	25.0	77.0	52.4	46.2			
Retail Supply Operations	21.6	26.0	31.1	5.9	5.9	5.9	5.9	5.9			
Maintenance of Instal- lation Equipment	0.9	0.9	2.9	1.4	2.9	8.8	6.0	5.3			
Other Base Services	7.4	7.6	24.0	11.7	23.8	73.6	50.1	44.2			
Bachelor Housing Operations and Furnishing	0.5	0.5	1.5	0.7	1.5	4.7	3.2	2.8			
Morale, Welfare, and Recreation	0.5	0.5	3.0	3.0	3.6	5.8	4.7	4.5			
Other Personnel Support	4.4	4.4	44.2	58.0	58.0	58.0	58.0	58.0			
Total BOS/RPMA Manpower	43.7	48.5	133.9	94.0	122.8	240.6	184.9	170.9			

TABLE 6.3 (Continued)

	T-37B	T-38A	T-43A	Recruit	Tech- nician	Crypto/ Intelli- gence	Cadet	Professional Education
Total RPMA Manpower	0.7	0.7	2.2	1.1	2.2	6.8	4.6	4.1
% of Mission and Student Population	0.3	0.3	0.2	0.1	0.2	0.3	0.2	0.2
Total BOS Manpower	43.0	47.8	131.7	92.9	120.6	233.8	180.2	166.8
% of Mission and Student Population	20.5	22.8	10.9	7.8	8.3	9.2	8.9	8.8

administration manpower projections for all of the TAC mission changes never exceeded 16.9, while those for SAC mission changes ranged from a low of 19.5 to a high of 63.2, tending on the whole to be higher than TAC. Taken together, these results provided additional evidence that the model was able to successfully differentiate among force structure changes and commands, generate correspondingly varied projections of workload and manpower requirements.

Table 6.3 identifies workload and manpower changes resulting from both aircraft and non-aircraft mission capability changes to ATC. As with predictions based upon aircraft or missile changes in the MAJCOMs, model projections resulting from non-aircraft mission changes also exhibited a high degree of variability as indicated in Table 6.3. Here, various student workload changes of 1,000 effect significantly different changes to workload indicators and functional manpower requirements. For example, an increase of 1,000 in crypto/intelligence training produced a change in administration manpower of 77.0, while the same numerical increase in recruit training resulted in an administration manpower increase of only 12.2. Similarly, maintenance of installation equipment manpower projections for the crypto/intelligence training change (8.8) were much higher than those for the recruit training change (1.4). BOS manpower changes, taken as a percentage of mission manpower and student population, also exhibited considerable variability. These ranged from 7.8% for recruit workload to 22.8% for T-38As. These variations clearly demonstrate the model's ability to achieve one of its principal objectives--the computation of explicit changes in BOS/RPMA manpower requirements associated with specific mission changes.

Suitably varied projections were also generated by the model when predicting the results of identical weapons system changes structured in one instance as a change to existing units, and in the next instance as a change accompanied by addition/deletion of units. These predictions differed significantly when based upon different unit structure assumptions. For example, while an addition of 24 A-7D aircraft to an existing

squadron in TAC produced a change of only 58.5 BOS/RPMA manpower authorizations, the same aircraft change when made as a squadron addition required a 93.8 BOS/RPMA manpower authorization increase. These manpower differences are consistent with expected workload differences. Tables 6.4 through 6.6 contain the GEBOS-M predictions based on force changes to existing squadrons in SAC, TAC, and ATC, respectively. These tables postulate identical mission changes as Tables 6.1 through 6.3, except that the latter do prescribe a new unit structure, while Tables 6.4 through 6.6 do not.

Changes to unspecified mission population,¹ other command manpower,² and tenant manpower were also analyzed. Model predictions based upon these types of changes are described in Table 6.7. Each change was based upon a manpower increment of 1,000. Once again, the model predicts variations within each command as well as variations among commands for the various population changes. For example, total BOS manpower required for the manpower changes in TAC varied from an increase of 73.8 predicted for a 1,000 increase in "other TAC manpower," to an increase of 135.1 projected for a 1,000 "tenant manpower" increase. Thus, although total mission population had increased by the same amount, BOS manpower required to support the different mission population changes is observed to vary significantly. By the same token, workload indicator changes exhibited significant variations among commands. For example, the model predicted an increase of 13,130 weighted rations served for a 1,000 unspecified mission population increase to ATC, with corresponding increases of only 2555 and 2786 for SAC and TAC respectively.

¹For GEBOS-M purposes, unspecified mission manpower consists of manpower with which is associated the average of all support manpower/workload coefficients applicable to total mission manpower within the command concerned. The model makes the necessary averaging computations when the workload input mode is used to introduce a mission manpower change.

²For GEBOS-M purposes, other command manpower consists of manpower which is aggregated within the model data base as a total without specification of program element code. The aggregation of manpower in these cases is necessary for output display convenience because of the large number of program elements involved, each covering fewer than 100 manpower authorizations.

TABLE 6.4

SAC MISSION CHANGES - ADDITIONS TO EXISTING SQUADRONS

	<u>Mission Changes</u>						<u>LGM-25</u>		<u>LGM-30</u>	
	<u>B-52D</u>	<u>B-52G</u>	<u>B-52H</u>	<u>KC-135A</u>	<u>KC-135Q</u>	<u>FB-111A</u>	<u>Titan</u>	<u>Minuteman</u>		
Aircraft Type										
Number of Aircraft	14	14	17	15	30	13				
Flying Hours/Aircraft	420	420	408	300	312	288				
Missile Type										
Number of Missiles							9	50		
	<u>Workload Changes</u>									
Base Population	750.1	645.6	857.0	324.0	724.9	654.7	589.7	599.0		
Mission Population	650.0	556.3	746.5	280.5	630.6	582.1	519.7	523.0		
Military Population	620.4	533.9	708.9	267.8	599.6	541.5	487.7	495.4		
Military Family Housing Floor Space	0	0	0	0	0	0	0	0		
Non-Housing Floor Space	0	0	0	0	0	0	0	0		
Travel Transactions	775.0	667.1	885.5	334.8	749.1	676.5	609.3	619.0		
Total Item Records	0	0	0	0	0	0	0	0		
Aviation Fuel Consumption	1962.4	1950.2	1921.3	873.8	1700.4	468.0	0	0		
Miles Driven	141.2	121.5	161.3	61.0	136.5	123.2	916.5	1349.7		
Military Vehicles	0	0	0	0	0	0	0	0		
Visiting Airmen Beds	2.4	2.1	2.8	1.0	2.3	2.1	1.9	1.9		
Weighted Rations Served	1607.2	1383.4	1836.2	694.7	1553.4	1402.9	1263.7	1283.8		

TABLE 6.4 (Continued)

	<u>B-52D</u>	<u>Manpower Changes</u>				<u>KC-135A</u>	<u>KC-135Q</u>	<u>FB-111A</u>	<u>Titan</u>	<u>Minuteman</u>
		<u>B-52G</u>	<u>B-52H</u>	<u>KC-135A</u>	<u>KC-135Q</u>					
Maintenance and Repair of Real Property	5.9	5.0	6.7	2.5	5.7	5.1	4.6	4.7		
Operation of Utilities for All Real Property	0	0	0	0	0	0	0	0		
Other Engineering Support	5.7	4.9	6.5	2.5	5.5	5.0	4.5	4.5		
Administration	34.0	29.2	38.8	14.7	32.8	29.6	26.7	27.1		
Retail Supply Operations	23.3	23.2	22.8	10.4	20.2	5.6	0	0		
Maintenance of Installation Equipment	1.7	1.5	1.9	0.7	1.6	1.5	10.9	16.1		
Other Base Services	20.4	17.5	23.3	8.8	19.7	17.8	16.0	16.3		
Bachelor Housing Operations and Furnishing	0	0	0	0	0	0	0	0		
Morale, Welfare, and Recreation	1.9	1.6	2.2	0.8	1.8	1.6	1.5	1.5		
Other Personnel Support	7.3	6.3	8.3	3.1	7.0	6.3	5.7	5.8		
Total	100.0	89.2	110.5	43.5	94.4	72.5	69.9	76.0		
Total RPMA Manpower	11.5	9.9	13.2	5.0	11.2	10.1	9.1	9.2		
% of Mission Population	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8		
Total BOS Manpower	88.5	79.3	97.3	38.5	83.2	62.5	60.9	66.8		
% of Mission Population	13.6	14.3	13.0	13.7	13.2	10.7	11.7	12.8		

TABLE 6.5
TAC MISSION CHANGES - ADDITIONS TO EXISTING SQUADRONS

Aircraft Type	<u>Mission Changes</u>					
	<u>A-7D</u>	<u>A-10A</u>	<u>F-4D</u>	<u>F-15A</u>	<u>F-111A/D</u>	<u>RF-4C</u>
Number of Aircraft	24	18	18	18	18	18
Flying Hours/Aircraft	320	368	240	244	240	264
	<u>Workload Changes</u>					
Base Population	495.0	301.8	466.3	805.8	561.3	391.9
Mission Population	436.6	265.1	408.2	719.8	496.8	341.3
Military Population	412.9	251.7	388.9	672.0	468.1	326.8
Military Family Housing Floor Space	0	0	0	0	0	0
Non-Housing Floor Space	0	0	0	0	0	0
Travel Transactions	1215.3	740.6	1144.7	1978.5	1378.1	961.9
Total Item Records	0	0	0	0	0	0
Aviation Fuel Consumption	438.5	284.3	552.5	510.8	540.0	528.9
Miles Driven	261.1	194.1	192.2	183.1	103.7	166.3
Military Vehicles	0	0	0	0	0	0
Visiting Airmen Beds	8.7	5.4	8.2	13.9	9.8	6.9
Weighted Rations Served	1213.9	739.9	1143.4	1975.9	1376.4	960.9
	<u>Manpower Changes</u>					
Maintenance and Repair of Real Property	7.8	4.8	7.4	12.8	8.9	6.2
Operation of Utilities for All Real Property	0	0	0	0	0	0
Other Engineering Support	1.3	0.8	1.3	2.2	1.5	1.1
Administration	6.5	4.0	6.1	10.6	7.4	5.2
Retail Supply Operations	11.9	7.7	15.0	13.8	14.6	14.3
Maintenance of Instal- lation Equipment	4.0	3.0	3.0	2.8	1.6	2.6
Other Base Services	17.2	10.5	16.2	28.0	19.5	13.6

TABLE 6.5 (Continued)

Manpower Changes (Continued)	A-7D	A-10A	F-4D	F-15A	F-111A/D	RF-4C
Bachelor Housing Operations and Furnishing	0.2	0.1	0.2	0.3	0.2	0.1
Morale, Welfare, and Recreation	0.7	0.4	0.6	1.1	0.8	0.5
Other Personnel Support	8.8	5.4	8.3	14.3	10.0	7.0
Total	58.5	36.6	58.1	86.0	64.5	50.6
Total RPMA Manpower	9.2	5.6	8.6	14.9	10.4	7.3
% of Mission Population	2.1	2.1	2.1	2.1	2.1	2.1
Total BOS Manpower	49.3	31.1	49.4	71.0	54.1	43.4
% of Mission Population	11.3	11.7	12.1	9.9	10.9	12.7

TABLE 6.6
ATC MISSION CHANGES - ADDITIONS TO EXISTING SQUADRONS

	<u>Mission Changes</u>		
Aircraft Type	T-37B	T-38A	T-43A
Number of Aircraft	35	35	12
Flying Hours/Aircraft	580	530	800
	<u>Workload Changes</u>		
Base Population	158.7	163.5	557.8
Mission Population	133.7	133.7	442.6
Military Population	94.6	97.4	332.4
Students Authorized	75.6	75.6	762.0
Military Housing Floor Space	0	0	0
Non-Housing Floor Space	0	0	0
Travel Transactions	166.2	171.2	584.0
Total Item Records	35.4	35.4	357.3
Aviation Fuel Consumption	304.5	602.9	679.7
Miles Driven	34.3	35.4	120.5
Military Vehicles	0	0	0
Visiting Airmen Beds	3.5	3.6	12.4
Weighted Rations Served	1,675.4	1,675.4	16,885.9
	<u>Manpower Changes</u>		
Maintenance and Repair of Real Property	0	0	0
Operation of Utilities for All Real Property	0.6	0.6	2.1
Other Engineering Support	0	0	0
Administration	6.9	7.1	24.3
Retail Supply Operations	4.9	9.2	14.3
Maintenance of Installation Equipment	0.8	0.8	2.8
Other Base Services	6.6	6.8	23.2
Bachelor Housing Operations and Furnishing	0.4	0.4	1.5
Morale, Welfare, and Recreation	0.5	0.5	2.9
Other Personnel Support	4.4	4.4	44.2
Total BOS/RPMA Manpower	25.0	29.8	115.3

TABLE 6.6 (Continued)

	<u>T-37B</u>	<u>T-38A</u>	<u>T-43A</u>
Total RPMA Manpower	0.6	0.6	2.1
% of Mission and Student Population	0.3	0.3	0.2
Total BOS Manpower	24.4	29.2	113.2
% of Mission and Student Population	11.7	14.0	9.4

TABLE 6.7

SELECTED MISSION CHANGES FOR ATC, SAC, AND TAC

	Command/Mission Change											
	ATC				SAC				TAC			
	+1,000 Unspecified Mission Population	+1,000 Other ATC Manpower	+1,000 Tenant Manpower	+1,000 Unspecified Mission Population	+1,000 Other SAC Manpower	+1,000 Tenant Manpower	+1,000 Unspecified Mission Population	+1,000 Other TAC Manpower	+1,000 Tenant Manpower	+1,000 Unspecified Mission Population	+1,000 Other TAC Manpower	+1,000 Tenant Manpower
<u>Workload Changes</u>												
Base Population	1212.4	1109.0	1114.0	1192.4	1113.9	1133.7	1136.2	1094.1	1156.6			
Mission Population	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0			
Military Population	722.3	660.8	663.7	986.6	921.6	938.0	947.6	912.4	964.6			
Students Authorized	592.4	0	0	---	---	---	---	---	---			
Military Family Housing Floor Space	313.4	0	0	476.9	0	0	305.6	0	0			
Non-Housing Floor Space	832.1	0	0	640.7	0	0	448.2	0	0			
Travel Transactions	1269.1	1161.0	1166.2	1232.1	1151.1	1171.5	2790.1	2686.6	2840.1			
Total Item Records	566.6	0	360.1	979.2	0	1169.0	786.9	0	2277.6			
Aviation Fuel Consumption	312.2	0	0	658.5	0	0	725.2	0	0			
Miles Driven	261.9	239.6	240.7	461.8	209.7	213.4	167.6	0	0			
Military Vehicles	2.5	0	0	1.4	0	0	5.6	0	0			
Visiting Airmen Beds	26.9	24.6	24.7	3.9	3.6	3.7	19.4	18.7	19.8			
Weighted Ratios	13,129.8	0	0	2554.7	2386.6	2429.0	2786.1	2682.8	2836.1			
<u>Manpower Functions</u>												
Maintenance and Repair of Real Property	36.5	0	0	45.2	8.7	8.9	23.4	17.3	18.3			
Operation of Utilities for All Real Property	10.5	4.3	4.3	8.5	0	0	9.3	0	0			
Other Engineering Support	2.8	0	0	9.0	8.4	8.6	4.0	3.0	3.1			
Administration	52.7	48.2	48.4	54.0	50.4	51.3	15.0	14.4	15.2			
Retail Supply Operations	11.6	0	4.5	22.7	0	17.8	19.7	0	57.1			
Maintenance of Installation Equipment	6.5	5.5	5.5	6.0	2.5	2.6	3.2	0	0			
Other Base Services	50.4	46.1	46.3	32.4	30.2	30.8	39.5	38.1	40.2			
Bachelor Housing Operations and Furnishing	3.2	2.9	3.0	0	0	0	0.4	0.4	0.4			
Morale, Welfare, and Recreation	3.7	2.0	2.1	3.0	2.8	2.9	1.5	1.5	1.6			
Other Personnel Support	34.4	0	0	11.6	10.8	11.0	20.2	19.5	20.6			
Total BOS/RPMA Manpower	212.4	109.0	114.0	192.4	114.0	133.8	136.2	94.1	156.6			
Total RPMA Manpower	49.8	4.2	4.3	62.7	17.2	17.5	36.6	20.3	21.5			
Percent of Mission Population	5.0	0.4	0.4	6.3	1.7	1.8	3.7	2.0	2.2			
Total BOS Manpower	162.5	104.8	109.8	129.7	96.8	116.3	99.6	73.8	135.1			
Percent of Mission Population	16.3	10.5	11.0	13.0	9.7	11.6	10.0	7.4	13.5			

All of these results further illustrate the model's capability to differentiate among commands, mission categories, force structure alternatives, and related key options. As importantly, the comparative values of model output indicators and manpower changes appeared realistic.

6.3 HISTORICAL VALIDATION

Comparison of GEBOS-M model results with historical data was another means employed to establish model validity. Data were assembled covering force structure, workload, and BOS/RPMA manpower for gross force structure changes to a given command over specified periods of time. GEBOS-M then simulated the identical force structure change. The resulting model estimates of workload and BOS/RPMA manpower changes were subsequently compared to the actual historical data previously assembled.

More specifically, three types of analyses were performed: historical changes to various mission capability and workload indicators were statistically analyzed by command, various factors computed from model predictions were compared with the same factors computed from actual historical data, and GEBOS-M estimates of aviation fuel consumption for each of the command installations were compared with historical data for the same installations. The first analysis sought to provide information pertaining to the variability and reliability of the historical data used, while the last two sought to verify a reasonably accurate degree of tracking of GEBOS-M predictions with historical data.

Tables 6.8 and 6.9 contain summaries of the types of historical data used in carrying out the historical validation. Table 6.8 indicates the actual force structure changes that were used in the validation procedure for SAC, TAC, and ATC, respectively. The table identifies force structure changes by base, time period over which the change took place (in years), and type of aircraft change. Table 6.9 lists the primary workload indicators and the time period for each for which data were available and utilized in validation.

TABLE 6.8

FORCE STRUCTURE CHANGES USED FOR HISTORICAL VALIDATION

<u>Base</u>	<u>Years</u>	<u>Type of Aircraft</u>
	<u>ATC</u>	
Columbus	1978-1979	T-37/T-38
Laughlin	1978-1979	T-37/T-38
Randolph	1978-1979	T-37/T-38
Reese	1978-1979	T-37/T-38
Vance	1978-1979	T-37/T-38
Williams	1978-1979	T-37/T-38
	<u>SAC</u>	
K. I. Sawyer	1976-1977	B-52
Wurtsmith	1976-1977	B-52
Barksdale	1976-1977	KC-135
	1977-1978	KC-135
	1978-1979	KC-135
Ellsworth	1976-1977	KC-135
Grissom	1976-1977	KC-135
	1977-1978	KC-135
	1978-1979	KC-135
McConnell	1976-1977	KC-135
	1977-1978	KC-135
	1978-1979	KC-135
Plattsburgh	1976-1977	KC-135
	1977-1979	KC-135
	<u>TAC</u>	
Davis Monthan	1977-1978	A-7/A-10
	1978-1979	A-7/A-10
Myrtle Beach	1976-1977	A-7
	1977-1978	A-10
Homestead	1976-1977	F-4
	1977-1978	F-4
	1978-1979	F-4
Langley	1976-1977	F-4
Luke	1976-1977	F-4
MacDill	1976-1977	F-4
	1977-1978	F-4
	1978-1979	F-4
Nellis	1976-1977	F-4

TABLE 6.9
WORKLOAD INDICATOR DATA AVAILABILITY

<u>Workload Indicator</u>	<u>Years</u>
Total Base Population	1975-1979
Military Population	1975-1979
Student Authorizations	1975-1979
Travel Transactions	1975-1979
Total Item Records	1976-1979
Aviation Fuel Consumption	1976-1979
Miles Driven	1975-1979
Military Vehicles	1975-1979
Weighted Rations Served	1975-1979

Tables 6.10 through 6.12 compare for each command the average annual historical change values actually experienced over time, with the FY79 change values selected in collaboration with AF/MPMZ for model validation purposes. The statistical measures identified by the columnar headings in Tables 6.10 through 6.12 were designed to provide an indication of change significance and data variability for each mission or workload indicator. Thus, for example, the value in Table 6.10 for average change as a percent of mean for B-52s in SAC (15.8%) indicates that the FY79 B-52 aircraft change represented a relatively small annual force structure change. In point of fact, the value for the average historical change as a percent of FY79 standard deviation for most indicators in Tables 6.10 through 6.12 indicates that the FY79 selected changes were relatively small. As a result, they had reduced utility as validators in making comparisons with GEBOS-M predictions based on identical force structure changes. They were vulnerable because of their relative size to distortions resulting from data "noise" created by base variability, in turn created by the significant existing resource and mission capability deviations across bases within MAJCOMs. In these circumstances, it must be pointed out that failure to use highly discernible and significant force structure change indicators in the validation process increased the likelihood of discrepancies between actual and GEBOS-M model predictions for the same force structure changes.

In concert with our statistical analysis of historical force structure and workload indicator changes, an analysis and comparison was made of certain GEBOS-M-predicted factors with the same factors using historical data. These factors were computed as ratios of specific workload indicator change values, based upon given mission capability changes. For the calculation of the factors using historical data, base average changes for the workload indicators were used. Tables 6.13 through 6.15 contain data for SAC, TAC, and ATC on the various factors calculated for given aircraft changes. For each factor, the GEBOS-M estimate, the actual value based on historical data, and the percentage difference between the two values are listed.

TABLE 6.10
COMPARISON OF AVERAGE HISTORICAL CHANGES TO FY79 DATA - SAC

<u>Indicator</u>	<u>Average Historical Change</u>	<u>Mean FY79 Value</u>	<u>FY79 Standard Deviation</u>	<u>Average Change as a % of Mean</u>	<u>Average Change as a % of Standard Deviation</u>
B-52 Aircraft	3.0	19.0	6.4	15.8	46.9
KC-135 Aircraft	5.2	20.0	7.4	26.0	70.3
Mission Manpower (All Aircraft)	69.4	813.0	439.0	8.5	15.8
Aviation Fuel Consumption	448.0	2,811.0	1,653.0	15.9	27.1
Total Base Population	162.0	5,090.0	2,159.0	3.2	7.5
Travel Transactions	652.0	4,084.0	2,882.0	16.0	22.6
Weighted Rations Served	2,013.0	16,325.0	4,538.0	12.3	44.4
Miles Driven	261.0	3,508.0	2,032.0	7.4	12.8
Military Population	139.0	4,213.0	1,876.0	3.3	7.4
BOS Manpower	11.9	1,087.0	429.0	1.1	2.8

TABLE 6.11
COMPARISON OF AVERAGE HISTORICAL CHANGES TO FY79 DATA - TAC

<u>Indicator</u>	<u>Average Historical Change</u>	<u>Mean FY79 Value</u>	<u>FY79 Standard Deviation</u>	<u>Average Change as a % of Mean</u>	<u>Average Change as a % of Standard Deviation</u>
A-7 Aircraft	18.0	72.0	---	25.0	---
A-10 Aircraft	21.3	42.0	29.1	50.7	73.2
F-4 Aircraft	16.1	67.0	24.4	24.0	66.0
Mission Manpower (All Aircraft)	418.0	1,748.0	909.0	23.9	46.0
Aviation Fuel Consumption	683.0	3,041.0	1,597.0	22.5	42.8
Total Base Population	375.0	5,580.0	1,996.0	6.7	18.8
Travel Transactions	1,271.0	4,561.0	3,173.0	27.9	40.1
Weighted Rations Served	4,701.0	18,570.0	5,776.0	25.3	81.4
Miles Driven	199.0	2,065.0	739.0	9.6	26.9
Military Population	334.0	4,653.0	1,719.0	7.2	19.4
BOS Manpower	52.0	1,053.0	527.0	4.9	9.9

TABLE 6.12
COMPARISON OF AVERAGE HISTORICAL CHANGES TO FY79 DATA - ATC

<u>Indicator</u>	<u>Average Historical Change</u>	<u>Mean FY79 Value</u>	<u>FY79 Standard Deviation</u>	<u>Average Change as a % of Mean</u>	<u>Average Change as a % of Standard Deviation</u>
Training Aircraft	39.5	125.0	67.0	31.6	59.0
Mission Manpower	127.0	975.0	189.0	13.0	67.2
Aviation Fuel Consumption	309.0	1,501.0	1,840.0	20.6	16.8
Total Base Population	144.0	4,735.0	2,478.0	3.0	5.8
Travel Transactions	207.0	5,913.0	4,222.0	3.5	4.9
Weighted Rations Served	528.0	49,425.0	86,819.0	1.1	0.6
Students Authorized	84.0	2,520.0	3,723.0	3.3	2.3
Military Population	187.0	2,821.0	1,709.0	6.6	10.9
BOS Manpower	31.0	1,037.0	1,147.0	3.0	2.7

TABLE 6.13
COMPARISON OF GEBOS-M AND HISTORICAL CHANGES - SAC

<u>Factor</u>	<u>GEBOS-M Estimate</u>	<u>Actual</u>	<u>% Difference</u>
<u>B-52s</u>			
Mission Manpower/Aircraft	46.4	28.0	-39.7
Aviation Fuel Consumption/Aircraft	140.2	98.6	-29.7
<u>KC-135s</u>			
Mission Manpower/Aircraft	18.7	12.9	-31.0
Aviation Fuel Consumption/Aircraft	56.7	91.2	60.8
BOS Manpower/Mission Population (%)	13.7	17.1	19.9

TABLE 6.14
COMPARISON OF GEBOS-M AND HISTORICAL CHANGES - TAC

<u>Factor</u>	<u>GEBOS-M Estimate</u>	<u>Actual</u>	<u>% Difference</u>
<u>A-7s/A-10s</u>			
Mission Manpower/Aircraft	16.3	20.5	25.8
Aviation Fuel Consumption/Aircraft	16.9	7.42	-56.1
<u>F-4s</u>			
Mission Manpower/Aircraft	22.7	37.5	65.2
Aviation Fuel Consumption/Aircraft	30.7	55.2	79.8
BOS Manpower/Mission Population (%)	11.8	12.4	4.8

TABLE 6.15
COMPARISON OF GEBOS-M AND HISTORICAL CHANGES - ATC

<u>Factor</u>	<u>GEBOS-M Estimate</u>	<u>Actual</u>	<u>% Difference</u>
<u>T-37s/T-38s</u>			
Mission Manpower/Aircraft	3.82	3.22	15.7
Aviation Fuel Consumption/Aircraft	17.2	7.82	54.5
Students Authorized/Aircraft	2.16	2.13	1.4
BOS Manpower/Mission Population and Students (%)	12.8	14.4	11.1

Differences between the GEBOS-M model estimates and the historical-based values for these factors varied considerably. In some cases, the discrepancy was as little as 1.4%, as in the case of students authorized/number of aircraft for ATC. In other cases, differences were as high as 78.9%, as, for example, in the case of change in aviation fuel consumption/change in aircraft for F-4s in TAC. As a general rule, factors for which the percent difference was small tended to be those for which the corresponding indicator change values had a high relative variability as indicated by the measures in Tables 6.10 through 6.12. Thus, for example, training aircraft changes and mission manpower changes in ATC (Table 6.12) had corresponding percent-of-standard deviation values of 59.0% and 67.2%, respectively; and the percent difference between historical (actual) data and that predicted by GEBOS-M in that instance was only 15.7% (see Table 6.15). Although that kind of correlation was not a hard and fast rule, it provides a substantive explanation for discrepancies between GEBOS-M projections and actual factor values.

The analysis of data variability stresses a point made earlier--the importance of using significant force structure changes in any validation effort based upon comparison of actual versus model predictions. We must add to that point here the need to assure that such an actual versus predicted validation process take some account of force structure impacts over time--a process that was not possible in the effort described here because both the actual force structure changes selected and the actual impact data used for comparison to GEBOS-M predictions were limited to FY79 exclusively. Resulting differences between actual versus GEBOS-M predictions are likely due in major respect to the fact that FY79 actual data used may not fully reflect the ultimate result of the force structure changes selected.

As an additional phase of the model prediction versus actual validation process, Tables 6.16 through 6.18 list the actual values and GEBOS-M estimates for average aviation fuel consumption for each of the bases in SAC, TAC, and ATC. For some bases, the values correspond very well: for Griffiss AFB in SAC, for example, GEBOS-M predicts an average

TABLE 6.16
COMPARISON OF ESTIMATED AND ACTUAL AVIATION FUEL CONSUMPTION - SAC

<u>Base</u>	<u>Estimated Aviation Fuel Consumption</u>	<u>Actual Aviation Fuel Consumption</u>
Andersen	1110	5040
Barksdale	4561	5204
Beale	1927	1199
Blytheville	2611	4501
Carswell	6725	6384
Castle	6470	1651
Dyess	4477	3801
Ellsworth	4216	3984
F. E. Warren	14	11
Fairchild	3196	3898
Grand Forks	2740	2846
Griffiss	3062	3018
Grissom	2483	2300
K. I. Sawyer	3497	3390
Loring	3194	3379
Malmstrom	64	328
March	3923	4197
McConnell	1334	1583
Minot	3237	3147
Offutt	3901	3205
Pease	1652	3000
Plattsburgh	2862	2554
Rickenbacker	1527	1657
Vandenberg	7	76
Whiteman	6	188
Wurtsmith	2691	2546

TABLE 6.17
COMPARISON OF ESTIMATED AND ACTUAL AVIATION FUEL CONSUMPTION - TAC

<u>Base</u>	<u>Estimated Aviation Fuel Consumption</u>	<u>Actual Aviation Fuel Consumption</u>
Bergstrom	1368	1822
Cannon	2053	4710
Davis Monthan	1837	2357
England	1031	1389
George	3673	3853
Holloman	3489	3688
Homestead	423	3925
Howard	16	1179
Eglin/Hurlburt	472	634
Langley	3031	2948
Luke	4880	5283
MacDill	2379	3291
Moody	2229	2233
Mountain Home	2235	2426
Myrtle Beach	1165	1038
Nellis	3957	6239
Seymour Johnson	4845	5101
Shaw	2747	2617

TABLE 6.18
COMPARISON OF ESTIMATED AND ACTUAL AVIATION FUEL CONSUMPTION - ATC

<u>Base</u>	<u>Estimated Aviation Fuel Consumption</u>	<u>Actual Aviation Fuel Consumption</u>
Chanute	0	1120
Columbus	2190	1849
Keesler	451	591
Lackland	0	0
Laughlin	2080	1816
Lowry	0	0
Mather	3431	6951
Maxwell	123	166
Randolph	1444	1279
Reese	2339	1853
Sheppard	1280	1383
Williams	2553	2505
USAF Academy	13	0
Vance	2150	*

* Data not available.

aviation fuel consumption of 3062, while the actual FY79 value was 3018. In other cases, the comparative values vary. Discrepancies for specific bases can be explained by a variety of extenuating factors. A principal factor was the inconsistency between flying hour and fuel consumption accounting at base level. Historical fuel consumption figures used for given bases represented actual fuel consumption by base, while fuel consumption estimated by flying hours includes all flying hours and all fuel consumed by base aircraft even if obtained at another location. These discrepancies alone may account for much or all of the observed differences between historical and predicted values. Taking them into account, GEBOS-M appears to provide estimates for fuel consumption that are reasonably close to historical values for the majority of bases. Overall correlation between the actual and GEBOS-M predictions was high (.69 for SAC, .77 for TAC, and .84 for ATC).

In sum, the predicted versus actual validation process suffered from a number of significant deficiencies limiting its utility:

- FY79 force structure changes selected in the test commands were limited in number, scope, and size, in turn limiting this segment of the validation process to a relatively narrow and non-representative sample for comparison to model output.
- The FY79 force structure change impacts concurrently lacked depth over time, and data comparisons to model predictions were constrained by certain key computational and accounting deficiencies.
- Neither broad Air Staff nor MAJCOM participation in the validation process was possible. Limited time and contract resources were available to AF/MPMZ and GRC in conducting the predicted versus actual validation exercise. Each of these factors impacted directly and substantively upon the quality of exercise results.

Despite these deficiencies and their predictable results, GEBOS-M demonstrated the capability to generate reasonable and realistic manpower/

workload/mission capability change estimates. It is concurrently clear that significant model enhancements can be effected through a well-ordered validation process with the full participation of Air Staff and MAJCOM manpower managers. Final validation exercises with the broad participation of Air Force manpower managers at Air Staff and field level will assure:

- An acid test of the programmatic consistency and reliability of model outputs, as well as the opportunity to update the data base and fine tune data interrelationships.
- The support of GEBOS-M by Air Force manpower management authorities, through their familiarization with model operation and capabilities, as a prerequisite to its extension Air Force-wide and its employment by the Air Staff as a primary manpower management tool.

In conducting final validation exercises, participants should be afforded every opportunity to focus upon the evaluation and fine tuning of model outputs in the light of their uniquely specialized manpower management insights within their own areas of functional expertise. Every element of the final validation exercises should be fully documented. The documented results should be collected and fully evaluated by a central exercise management authority fully qualified in the intricacies of model construction/operation, such that maximum benefit is derived from lessons learned at individual locations/commands through across-command applications.

6.4 VALIDATION BY COMPARISON WITH DEFENSE RESOURCE MODEL (DRM) ESTIMATES

The final procedure used to validate the GEBOS-M model was the comparison of GEBOS-M estimates of BOS and mission manpower requirements for a given force structure change with estimates produced by the GRC-developed DRM based on the same mission change. DRM is a budget impact model developed for the Congressional Budget Office (CBO) and designed to project force and support budget resources in terms of budget authority, outlays, manpower end strengths, forces, and major procurement end items for the

entire Department of Defense. The model can project the manpower resource increases or decreases associated with changes in primary forces. More specifically, it can express BOS/RPMA manpower changes in terms of officer and enlisted end strength for active forces, and civilian end strength.

Identical force structure changes were input into the DRM and GEBOS-M models and the resulting projections of mission manpower and BOS/RPMA manpower requirements compared. GEBOS-M estimates were computed based on an addition of one squadron of the aircraft type being changed, and certain input values for military housing and non-housing floor space increases. The latter adjustment was made in order to account for manpower required to support floor space increases resulting from changes to mission population. While GEBOS-M does not normally compute such support requirements automatically as part of support manpower, DRM does, and the adjustment was made in order to compensate for this difference in definition. Specifically, a linear relationship between floor space increases and mission manpower increases was assumed and calculated based upon model runs incorporating a 1,000 unspecified mission population increase. The model was then rerun, adding these floor space increases as mission capability change inputs. The resulting manpower projections were compared with DRM estimates. Table 6.19 contains a summary of these model results. For each force structure change, three predicted quantities were examined: mission manpower, BOS/RPMA manpower, and BOS/RPMA manpower as a percentage of mission manpower. For each of these items, the table identifies in turn the DRM model estimate, the GEBOS-M model estimate, and the percent difference between the two estimates.

As the table indicates, model results were generally comparable. For certain mission changes, however, such as those for A10 and F-15A aircraft, the differences between the two model estimates were significant. Such discrepancies may be largely due to the fact that these aircraft were being phased in or out in FY79. Whereas GEBOS-M results are based on equations derived from actual manpower requirements data, DRM estimates of manpower requirements are based on projected figures for FY82. That these discrepancies may also be at least partially

TABLE 6.19
COMPARISON OF DRM AND GEBOS-M ESTIMATES
OF FORCE STRUCTURE CHANGES

<u>Mission Change</u>	<u>DRM Model Estimate</u>	<u>GEBOS-M Model Estimate</u>	<u>% Difference</u>
<u>50 Minutemen</u>			
Mission Manpower	573.0	527.0	8.7
BOS Manpower	133.0	122.1	8.9
% BOS/Mission Manpower	23.2	23.2	0
<u>18 A-10As</u>			
Mission Manpower	390.0	640.2	39.1
BOS Manpower	95.0	85.4	11.2
% BOS/Mission Manpower	24.4	13.3	83.5
<u>18 F-4Ds</u>			
Mission Manpower	571.0	783.3	27.1
BOS Manpower	143.0	128.6	11.2
% BOS/Mission Manpower	25.0	16.4	52.4
<u>18 F-15As</u>			
Mission Manpower	503.0	1094.9	54.1
BOS Manpower	122.0	217.5	43.9
% BOS/Mission Manpower	24.3	19.9	22.1
<u>18 F-111A/Ds</u>			
Mission Manpower	618.0	871.8	29.1
BOS Manpower	153.0	141.0	8.5
% BOS/Mission Manpower	24.8	16.2	53.1
<u>18 RF-4Cs</u>			
Mission Manpower	723.0	716.3	0.9
BOS Manpower	178.0	170.3	4.5
% BOS/Mission Manpower	24.6	23.8	3.4
<u>17 B-52Hs</u>			
Mission Manpower	1238.0	1201.2	3.1
BOS Manpower	295.0	255.3	15.6
% BOS/Mission Manpower	23.8	21.3	11.7

accounted for by GEBOS-M's superior sensitivity is suggested by the relative constancy of the BOS manpower/mission manpower percentage for DRM, and the relative variance of the same figures for GEBOS-M. Thus, for DRM, all of these percentage values fall within the range 23.2%-25%; for GEBOS-M, they ranged from a low of 13.3% to a high of 23.8%. Such figures suggest that GEBOS-M is better able to differentiate among force structure changes as they impact on BOS manpower requirements as a function of mission manpower. In general, then, a certain discrepancy between GEBOS-M and DRM values was to be expected based upon these differing sensitivities. Nevertheless, GEBOS-M values were sufficiently consistent with DRM estimates to further substantiate GEBOS-M's predictive validity.

APPENDIX A
DATA ACCESSIONS LIST

1. BOS/RPMA DATA ACCESSIONS

a. <u>Manpower Data Elements</u>			<u>Source No.</u>
1.	DoD Functional Category 30	Maintenance and Repair of Real Property	1, 2
2.	DoD Functional Category 32	Operation of Utilities for all Real Property	1, 2
3.	DoD Functional Category 33	Other Engineering Support	1, 2
4.	DoD Functional Category 36	Administration	1, 2
5.	DoD Functional Category 37	Retail Supply Operations	1, 2
6.	DoD Functional Category 38	Maintenance of Installation Equipment	1, 2
7.	DoD Functional Category 39	Other Base Services	1, 2
8.	DoD Functional Category 40	Bachelor Housing Operations and Furnishings	1, 2
9.	DoD Functional Category 41	Morale, Welfare, and Recreation	1, 2
10.	DoD Functional Category 42	Other Personnel Support	1, 2

b. <u>Workload Indicator Data Elements</u>	<u>Source No.</u>
1. Total base officers	1
2. Total base airmen	1
3. Total base civilians	1
4. Total base contract manyear equivalents	2
5. Military family housing units	3
6. Military family housing floor space	3
7. Base total buildings	3
8. Base total floor space	3
9. Heating capacity (in BTUs)	3
10. Air conditioning capacity	3
11. Electric power capacity	3
12. Drinking water capacity	3
13. Travel transactions	4
14. Distillates	5
15. Residuals	5
16. Gasoline	5
17. Aviation fuel	6
18. Supply transactions	7
19. Equipment transactions	7
20. Supply item records	7
21. Equipment item records	7
22. Vehicles on hand	8
23. Vehicles authorized	8
24. Dormitory beds	3
25. Dormitory floor space	3
26. Visiting airmen beds	3
27. Visiting airmen floor space	3
28. Visiting officer beds	3
29. Visiting officer floor space	3
30. Weighted rations	9
31. Total land area	10
32. Total building area	10
33. Total BOS budget	10
34. End FY 79 authorized full-time assigned personnel	10

	<u>Source No.</u>
35. FY 79 total population	10
36. FY 79 mission population	10
37. End FY 79 BOS personnel	10
38. End FY 79 population supported	10
39. Military vehicles	11
40. Total vehicles	11
41. Vehicle equivalents	11
42. Miles driven	11
43. Transactions audited	4
44. Total Air Force members	4
45. Civilian pay accounts	4
46. Commercial service transactions	4
47. Materiel transaction workload	4
48. Electricity consumption	10
49. Oil consumption	10
50. Coal consumption	10
51. Natural gas consumption	10
52. Propane gas consumption	10
53. Total energy consumption	10
54. Total energy cost	10

2. MISSION DATA ACCESSIONS

a. <u>Mission Manpower Data Elements</u>	<u>Source No.</u>
1. Manpower by base, command, and program element	1
b. <u>Mission Workload Data Elements</u>	
1. Aircraft authorizations by base, command, and M/D/S	12
2. Flying hours by base, command, and M/D/S	13
3. Sorties by base, command, and M/D/S	13
4. Aircraft fuel consumption rates by command and M/D/S	14
5. Total FY 79 personnel assigned to formal school or training activities	10
6. Total average daily load of students	10
7. Total annual output of students	10
8. Number of buildings used in school or training activities	10
9. School or training building area	10
10. Total number of squadrons assigned	10
11. Total number of combat type squadrons assigned	10
12. Number of aircraft assigned	10
13. Total training costs	5
14. Total number of students authorized	1

3. SOURCES

<u>Source No.</u>	<u>Source Reference</u>	<u>Date</u>
1	RCS: HAF-MPM(AR) 7102 Manpower Authorization Transaction Report	As of 30 Sep 79
2	RCS: HAF-MPM(AR) 7105 Commercial or Industrial Activities and Contract Services Report	As of 30 Sep 79
3	RCS: HAF-LEE(RA) 7115 Facilities and Land Summary	As of 30 Sep 79
4	RCS: HAF-ACF(M) 7104 Report of Accounting and Finance Activities	Oct 78 - Sep 79
5	M-34 Report Ground Fuels Worldwide Inventory by base	Oct 78 - Sep 79
6	PCN DO22AFX1A AV Fuels Worldwide Inventory by Command	Oct 78 - Sep 79
7	M-32 Monthly Base Supply Management Report	Oct 78 - Sep 79
8	RCS: LOG-LOW(M) 7136 REMS Authorizations and Assets	8 Sep 79
9	HQ AFESC/DEHF Mr. Guterman, Manual Report for Weighted Rations	Oct 78 - Sep 79
10	DD-MRA&L(OT) 7765 Domestic Base Factors Report	Sep 79
11	Special Request to HQ SAC/LGT, HQ TAC/LGT, HQ ATC/LGT	As of 30 Sep 79
12	Program Document 81-3	18 May 79
13	SSA-21 USAF Flying Hours, Landings, Sorties by Organization, maintained by AF/PAXRB	Jan - Sep 79
14	AFP-173-13 USAF Cost and Planning Factors	1 Feb 80

APPENDIX B

MANPOWER AND WORKLOAD DATA

This appendix presents detailed computer listings of the manpower and workload data employed in and analyzed by GEBOS-M.

Computer printouts appearing on the following pages are named and structured as indicated in the first two columns of the list below; computer file formats (FORTRAN) are presented for information in the final column.

<u>File Name</u>	<u>Variables*</u>	<u>Format (FORTRAN)</u>
DATA1	V1 through V12	F1.0, 1x, F2.0, 10(1x, F6.0)
DATA2	V13 through V23	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA3	V24 through V34	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA4	V35 through V45	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA5	V46 through V56	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA6	V57 through V67	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA7	V68 through V78	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA8	V79 through V89	1x, F1.0, 2x, F2.0, 9(1x, F6.0)
DATA9	V90 through V92	F2.0, 1x, F6.0, 1x, F1.0
DATA10	V93 through V94	F6.0, 1x, F6.0
DATA11	V95 through V97	1x, F3.0, F6.0, F7.0

* Variables are defined in Table 2.3, Section 2 of this report.

The printouts appearing on succeeding pages are arranged by file name in ascending numerical order. The first column in each printout first identifies the printout line number. All following columns identify the values of the variables cited in the foregoing listing, in the order shown.

!EDIT DATA1

*LIST

1	1	1	433	95	126	355	182	70	137	21	45
257											
2	1	2	293	53	104	201	232	50	159	9	31
56											
3	1	3	98	17	40	149		15	126	3	19
69											
4	1	4	350	56	115	463	286	117	268	21	52
373											
5	1	5	29		85	522	175	55	416	27	77
912											
6	1	6	211	46	101	182	227	24	130	12	30
40											
7	1	7	307	97	187	413	205	45	321	20	42
245											
8	1	8	324	64	165	293	342	69	247	22	40
77											
9	1	9	260	79	177	427	234	44	216	16	44
91											
10	1	10	30		94	554	269	32	239	24	35
67											
11	1	11	130	19	112	197	231	34	107	11	27
55											
12	1	12	1081	350	53	36		10	18		
0											
13	1	13	372	96	103	447	243	59	313	20	54
392											
14	1	14	190	61	116	209	275	31	165		29
50											
15	1	15	397	17	96	380	157	43	203	12	39
72											
16	1	16			9	93	6		35		5
7											
17	2	1	337	72	117	236	345	102	342	21	34
78											
18	2	2	296	88	117	321	367	37	381	13	40
127											
19	2	3	280	102	89	264	327	55	269	15	34
83											
20	2	4	195	45	81	208	245	45	213	9	27
68											
21	2	5	241	49	96	267	358	57	339	13	36
74											
22	2	6	220	53	84	286	335	60	315	16	34
103											
23	2	7	247	54	82	252	313	65	279	11	32
95											
24	2	8	393	75	84	290	333	143	319	19	40
165											
25	2	9	334	43	79	236	187	111	229	12	36
160											
26	2	10	315	91	115	246	307	68	272	17	40
99											
27	2	11	378	60	98	257	308	116	235	3	35
138											
28	2	12	348	77	92	338	336	176	381	15	36
80											
29	2	13	201	76	106	214	279	61	237	11	29

64										
30	2 14	244	85	82	237	281	73	236	10	27
54										
31	2 15	247	87	112	236	331	71	246	16	33
72										
22	2 16	294	71	92	260	244	121	282	13	27
132										
23	2 17	336	88	125	275	320	62	347	11	35
105										
34	2 18	338	66	91	236	323	91	267	9	34
75										
35	2 19	432	78	96	279	312	126	307	10	39
156										
36	2 20	523	108	193	738	374	97	535	12	58
91										
37	2 21	282	60	95	234	281	73	299	11	27
28										
38	2 22	285	53	99	237	277	61	264	15	36
99										
39	2 23	249	83	96	210	252	54	219	12	24
39										
40	2 24	667	106	256	313	229	112	258	15	40
72										
41	2 25	334	58	95	218	204	84	231	9	32
115										
42	2 26	232	56	85	216	280	64	221	10	31
30										
43	3 1	250	40	62	296	315	62	243	10	36
32										
44	3 2	201	53	138	137	290	51	125	10	35
77										
45	3 3	320	96	120	326	372	80	304	10	39
71										
46	3 4	197	32	119	213	262	46	218	9	31
64										
47	3 5	373	59	136	257	335	51	234	11	36
132										
48	3 6	248	68	119	245	420	79	257	10	34
113										
49	3 7	339	72	125	287	351	62	288	17	42
166										
50	3 8	408	36	31	253	223	34	257	26	35
32										
51	3 9				197	253	41	209		33
32										
52	3 10	364	93	223	265	417	66	463	13	40
155										
53	3 11	737	79	113	315	379	59	293	11	37
101										
54	3 12	354	81	139	266	339	69	264	3	32
106										
55	3 13	172	39	100	224	262	39	193		31
71										
56	3 14	370	87	88	139	275	50	132	11	33
108										
57	2 15	180	52	120	216	266	42	227	9	29
64										
58	2 16	424	84	103	363	441	77	329	21	44
134										
59	3 17	289	64	122	270	341	62	267	12	32
80										
60	3 18	231	67	105	249	363	62	276	14	37
73										

EDIT DATA
LIST

1	1	01	304	2194	1315	632	621	2213	6664	925	535
2	1	02	455	1344	531	148	448	1054	2317	618	1205
3	1	03	70	324	238	50	30	87	1021	133	313
4	1	04	342	4539	2581	370	1039	2423	3439	1484	1242
5	1	05	1563	4964	2070	959	194	1001	9921	1024	
6	1	06	440	1623	553	158	332	798	2177	505	2170
7	1	07	429	2847	4028	380	235	1306	6197	503	455
8	1	08	374	2930	1271	238	1065	1627	4093	1363	1760
9	1	09	820	1432	1582	293	537	1759	6314	1062	1687
10	1	10	1651	3324	2456	103	443	1596	4437	709	
11	1	11	461	1459	644	124	302	543	1746	492	1050
12	1	12	33	232	2009	2		24	2	0	
13	1	13	713	2745	1675	1209	752	1531	7029	1160	1705
14	1	14	516	1877	751	278	808	930	2512	1054	2015
15	1	15	1103	1213	1898	171	825	2416	7365	989	510
16	1	16	363	387	144	1718	230	314	1340	438	
17	2	01	387	3219	669	9	1061	2205	4768	1439	21227
18	2	02	921	4456	829	106	545	1552	5127	973	5025
19	2	03	551	3526	563	52	1375	2208	4392	1613	4384
20	2	04	363	2234	362	32	445	1293	2461	612	1320
21	2	05	736	3799	933	91	566	1071	3190	782	2552
22	2	06	1097	4472	439	82	505	1137	3323	810	1385
23	2	07	772	4114	452	34	694	1165	3271	892	1323
24	2	08	993	5091	590	72	798	2530	5586	1281	15894
25	2	09	557	3109	458	40	567	1479	3704	810	18052
26	2	10	513	3352	609	78	1480	1969	6098	1764	2131
27	2	11	731	4376	486	53	1051	3998	6566	1416	23947
28	2	12	633	3063	2926	110	316	1026	5661	592	2887
29	2	13	285	1948	533	69	595	1500	3396	753	2175
30	2	14	479	3222	416	28	876	3021	4945	1108	3190
31	2	15	435	2993	620	21	538	3048	6355	805	18125
32	2	16	614	3764	530	97	1063	1795	4362	1568	20446
33	2	17	691	3383	917	141	597	1023	3933	857	7193
34	2	18	534	2850	482	46	404	1336	3598	620	1140
35	2	19	800	4903	601	122	1176	3142	5967	1521	17762
36	2	20	3259	8498	1739	244	1097	4297	9455	1374	14065
37	2	21	410	2867	492	133	325	1229	3486	519	2240
38	2	22	515	3229	417	106	1171	2565	4909	1373	1205
39	2	23	203	1599	746	13	290	1223	3691	534	2055
40	2	24	931	2162	1482	1687	2115	2855	8186	3157	28863
41	2	25	447	2682	429	97	566	1804	3505	896	14513
42	2	26	374	2362	384	37	824	2470	4126	1023	1329
43	3	01	827	3594	760	68	403	923	2908	615	1365
44	3	02	455	3539	362	38	603	1341	3200	836	1132
45	3	03	686	4126	1316	157	768	1587	4727	1159	10955
46	3	04	291	2676	453	79	296	799	2213	466	1455
47	3	05	584	4301	459	225	426	2003	4132	705	1451
48	3	06	639	4830	1147	149	688	2086	5353	1143	3574
49	3	07	564	4276	1060	190	894	1843	4537	1196	2938
50	3	08	201	1463	695	30	311	1109	2668	448	7755
51	3	09	489	2933	335	29					
52	3	10	1827	7192	1550	270	621	2672	6118	1032	3456
53	3	11	707	5234	1055	579	535	1276	4036	1036	8563
54	3	12	591	4471	808	147	252	1170	4063	540	4824
55	3	13	358	2435	465	118	134	398	1683	348	1336
56	3	14	430	3693	411	101	1054	2108	3968	1269	2420
57	3	15	312	2423	452	68	439	1055	2398	628	1225
58	3	16	1042	6190	1067	783	1264	2043	5208	1671	3864
59	3	17	678	4320	552	93	943	2170	4469	1227	2620
60	3	18	925	4478	493	79	876	2426	4810	1220	3524

CREDIT DATA3

LIST

1	1	01	4603	6373	1	5525	207	247	332	1120	37091
2	1	02	1611	5171	69	3019	126	0	359	1349	46327
3	1	03	72	2325	28	1652					
4	1	04	7030	22186	412	13809	366	0	46	591	62067
5	1	05				6970	394	0	739	0	22971
6	1	06	108	5370	45	2618	146	0	38	1316	47877
7	1	07	46	7420	10776	5593	206	0	525	0	45036
8	1	08	16610	4023	129	2744	510	0	98	6951	69475
9	1	09	422	14816	137	13262	243	54	103	166	37381
10	1	10			12790219		240	0	338	1279	49250
11	1	11	954	2756	68	2096	147	0	43	1353	43129
12	1	12	0	0	0						
13	1	13	75	14876	247	7352	276	0	50	1383	58113
14	1	14	4533	6041	69	2227	252	0	27	2505	60219
15	1	15	157	6304	454		294	0	102	0	31521
16	1	16	438								
17	2	01	8769	3621	22	2229	711	0	584	5040	35910
18	2	02	2033	9979	162	6964	772	0	1083	5204	72242
19	2	03	16428	3961	178	4217	468	0	632	1199	37322
20	2	04	1584	5072	89	2353	319	0	207	4501	44422
21	2	05	576	7111	90	4124	524	0	67	6384	70093
22	2	06	5922	4690	150	3953	760	0	117	1651	83456
23	2	07	0	6710	94	4673	630	0	121	3801	64238
24	2	08	1218	2131	569	3419	1211	0	595	3984	72063
25	2	09	673	1196	165	2240	705	0	256	11	30419
26	2	10	10403	1578	546	2589	678	209	1306	3898	49375
27	2	11	105	1960	198	2286	1010	4097	2377	2846	65767
28	2	12	152	5438	36	12073	649	6310	2552	3018	49171
29	2	13	2615	2026	8	2720	336	1767	193	2300	39153
30	2	14	2668	1604	169	2356	612	2648	2560	3390	61704
31	2	15	3573	977	614	2970	682	0	6589	3379	50404
32	2	16	1087	2354	248	2395	810	163	636	328	36839
33	2	17	225	4661	72	4203	486	0	237	4197	57509
34	2	18	47	5391	262	2820	532	0	497	1583	40284
35	2	19	135	2242	325	2404	1226	894	918	3147	72373
36	2	20	4232	13673	507	13876	522	0	1393	3205	77876
37	2	21	1995	1221	242	2895	540	2322	731	3000	49515
38	2	22	26	1019	348	2550	588	573	772	2554	65778
39	2	23	2732	2904	235	4430	355	0	143	1657	27727
40	2	24	12908	3095	209	5428	904	0	1699	76	48160
41	2	25	2368	5325	121	2671	524	654	242	138	25913
42	2	26	2289	735	122	2735	386	1998	1737	2546	43853
43	3	01	86	6035	88	7732	354	0	32	1322	30070
44	3	02	4131	1752	89	2073	320	0	64	4710	70480
45	3	03	5607	7521	109	3878	722	0	124	2357	72643
46	3	04	1	4683	48	2602	290	0	49	1389	42066
47	3	05	25643	2212	77	3502	484	0	142	3853	77251
48	3	06	12470	4375	251	3914	691	0	119	3628	114095
49	3	07	3275	10232	41	3132	525	0	643	3925	92000
50	3	08		3852		2098	280	0	704	1179	36914
51	3	09				2436	384	0	507	634	43615
52	3	10	0	12045	221	14239	630	2941	1210	2948	105897
53	3	11	5041	9902	63	4491	729	0	406	5283	110773
54	3	12	0	8940	45	5089	525	0	307	3291	32765
55	3	13	4570	3300	55	2660	254	336	477	2233	50611
56	3	14	6835	3691	199	2198	391	0	1073	2426	72176
57	3	15	1498	2449	736	2522	227	424	485	1038	47672
58	3	16	5887	8091	83	7568	913	0	905	6239	119265
59	3	17	4532	7297	147	3098	614	1923	193	5101	34884
60	3	18	1763	9555	93	3310	408	48	1107	2617	30726

EDIT DATA4
LIST

1	1	01	4785	4002	1006	333	352	1000	167	31	40
2	1	02	3033	3715	656	241	244	0	0	15	11
3	1	03				83	84	133	42	55	24
4	1	01	8825	8399	1173	455	422	1504	293	374	134
5	1	05	7048	2270	648	420	411	1071	299	148	68
6	1	06	3205	3530	628	205	207	0	0	0	0
7	1	07	7265	5422	1181	289	231	692	222	327	153
8	1	08	5756	8001	1021	445	442	0	0	135	72
9	1	09	6807	2413	380	504	324	295	93	1070	357
10	1	10	6058	4684	390	2035	253	158	39	200	96
11	1	11	3398	3971	627	249	229	0	0	12	17
12	1	12				536	535			0	0
13	1	13	6977	5499	1163	338	340	1050	202	107	46
14	1	14	4158	5380	783	249	248	0	0	0	0
15	1	15	4793	3708	1142	388	379	0	0	71	46
16	1	16								0	0
17	2	01	6965	7493	966	717	672	0	0	117	41
18	2	02	6556	6486	1195	824	770	294	63	116	55
19	2	03	5991	4896	924	20472	447	0	0	23	9
20	2	04	4692	4305	804	323	313	0	0	27	26
21	2	05	6516	6520	1128	468	454	0	0	114	48
22	2	06	7200	6878	1037	385	374	72	22	312	137
23	2	07	7276	6077	1030	504	504	53	15	55	30
24	2	08	9088	6617	1120	811	809	0	0	24	37
25	2	09	5546	3451	671	612	602	2	1	23	28
26	2	10	6837	5693	1035	508	502	193	52	83	49
27	2	11	9659	6224	1220	791	785	0	0	4	2
28	2	12	10642	8621	1776	773	751	47	13	44	21
29	2	13	7004	3811	817	390	397	152	51	90	44
30	2	14	6270	6040	1134	479	465	0	0	30	16
31	2	15	3746	5413	935	513	507	0	0	54	26
32	2	16	7763	4400	893	730	760	0	0	45	22
33	2	17	7612	5811	963	437	426	210	45	102	43
34	2	18	6532	4589	888	503	594	56	11	88	43
35	2	19	9623	7398	1319	802	773	44	13	32	13
36	2	20	9726	8656	1416	511	518	0	0	84	33
37	2	21	6452	5222	1073	486	458	0	0	28	24
38	2	22	7933	5916	1072	460	482	348	92	54	24
39	2	23	6013	3425	801	321	341	75	22	58	24
40	2	24	8025	5713	996	1535	807	90	27	332	17
41	2	25	5580	2951	660	500	505	74	16	19	14
42	2	26	10038	4820	924	406	361	41	12	18	17
43	3	01	18535	7641	1081	1132	1089	241	51	95	50
44	3	02	9223	6004	951	439	428	0	0	64	42
45	3	03	9088	8478	1122	673	716	0	0	181	87
46	3	04	7288	4105	799	358	346	44	26	32	16
47	3	05	11614	7344	1027	438	412	52	10	97	30
48	3	06	15427	9688	1743	975	1029	92	25	218	117
49	3	07	15626	8598	1121	620	582	140	25	215	97
50	3	08	4961	4657	764	352	344	126	49	61	30
51	3	09	6770	4495	881	612	567	0	0	0	0
52	3	10	12134	9790	1482	616	583	122	25	108	57
53	3	11	11840	9745	1138	748	732	52	16	122	66
54	3	12	10353	8709	1082	862	805	125	25	122	63
55	3	13	7193	4311	776	295	290	0	0	0	0
56	3	14	3461	5603	968	389	382	0	0	18	23
57	3	15	7531	5224	920	372	370	0	0	52	24
58	3	16	18510	11231	1613	1398	1292	495	111	133	55
59	3	17	12185	8090	1153	516	515	34	23	44	23
60	3	18	11192	7762	1016	809	766	90	25	126	89

EDIT DATA5
LIST

1	1	01	36	1430	20	0	0	26	57138	194955	1019
2	1	02	9	121	9	2	183	33	43470	148320	0
3	1	03	17	184	3	0	0	3	16206	55295	0
4	1	04	22	1477	29	3	22	36	143188	489577	0
5	1	05	127	1194	32		50	46	109427	373365	0
6	1	06	20	178	9	2	194	35	31790	108467	0
7	1	07	55	1197	20	0	0	28	70117	239239	0
8	1	08	27	301	23	9	90	26	55328	183779	0
9	1	09	41	563	9	1	20	21	70942	242054	0
10	1	10	20	215	14	3	242	27	72560	247575	
11	1	11	9	163	3	2	206	32	27042	92267	
12	1	12									
13	1	13	59	1730	27	3	143	45	91272	311420	0
14	1	14	16	217	10	3	234	36	49749	169744	0
15	1	15	16	1229	5	1	52	111	80314	274031	0
16	1	16	12	163	4	2	209	29	21565	73530	0
17	2	01									
18	2	02	0	0	19	5	78	0	71693	244617	0
19	2	03	0	0	17	4	64	0	102653	350252	0
20	2	04	0	0	11	2	30	0	28565	97464	0
21	2	05	2	16	20	4	30	12	50214	171330	0
22	2	06	9	37	14	4	33	40	42211	144024	0
23	2	07	0	0	13	5	36	0	42129	143744	0
24	2	08	0	0	21	7	63	0	74573	254443	0
25	2	09	0	0	15	5	20	0	69364	236670	0
26	2	10	19	218	17	4	55	5	54208	184958	0
27	2	11	0	0	19	5	48	0	155174	529454	0
28	2	12	0	0	13	3	52	0	64233	219334	0
29	2	13	0	0	16	4	65	0	39472	135600	244
30	2	14	0	0	12	3	57	0	78091	239150	123
31	2	15	0	0	12	3	44	0	48508	165509	412
32	2	16	0	0	16	5	10	0	100572	343152	0
33	2	17	0	0	18	4	43	0	46930	160296	0
34	2	18	2	39	18	5	43	5	58533	199715	0
35	2	19	0	0	18	6	59	0	103209	352149	0
36	2	20	0	0	22	4	42	0	139468	475865	0
37	2	21	0	0	17	4	53	0	37777	128895	0
38	2	22	1	10	13	4	73	5	41981	153475	0
39	2	23	0	0	14	4	63	0	37073	126493	716
40	2	24							135487	462282	0
41	2	25	0	0	13	4	9	0	64001	218371	0
42	2	26	0	0	11	2	31	0	40784	163227	0
43	3	01	0	0	25	5	89	0	47839	163227	0
44	3	02	1	9	13	4	13	12	38100	129997	0
45	3	03	3	42	20	9	37	24	70600	240887	0
46	3	04	0	0	13	3	30	0	36900	159903	0
47	3	05	2	20	18	6	126	28	43800	149446	0
48	3	06	2	19	21	6	198	19	63300	215980	0
49	3	07	3	21	24	6	144	7	101800	102701	0
50	3	08									
51	3	09	2	16	17	2		3	30100	347342	0
52	3	10	0	0	25	5	7	0	100100	341541	0
53	3	11	7	35	23	2	244	67	72200	246346	0
54	3	12	1	12	13	4	34	23	82300	232514	0
55	3	13	0	0	12	3	58		23500	97242	
56	3	14	1	10	13	4	99	13	51300	175036	320
57	3	15	0	0	12	5	63	0	48600	165323	0
58	3	16	2	20	25	10	3	15	81100	276713	0
59	3	17	0	0	13	5	102	0	69700	237816	0
60	3	18	2	15	20	5	125	14	73200	250100	0

EDIT DATA6

LIST

1	1	01	2125	6291	40134	4340	7701	5402	5407	12129	1434
2	1	02	4937	2302	20684	2446	3234	1904	1330	7538	394
3	1	03	1119	1018	12164	1230	1990	1295	695	5616	463
4	1	04	3547	8438	28416	9323	13434	11066	2368	37168	2027
5	1	05	6823	9848	43152	9437	22323	19546	2777	113440	2062
6	1	06	5309	2177	19766	2750	3052	1343	1204	6836	340
7	1	07	1948	6175	39307	7363	10923	3668	2250	44165	1522
8	1	08	5911	4093	38711	5298	6705	4447	2258	15887	583
9	1	09	3966	6315	52278	4306	6197	3719	2473	32537	1193
10	1	10	3771	4436	33912	7569	7704	5912	1792	26650	412
11	1	11	3546	1746	20347	2696	3043	1831	1212	10179	426
12	1	12									
13	1	13	5788	7022	51252	6415	10278	7203	3075	15456	1864
14	1	14	4728	2501	28441	2430	3739	2391	1398	19060	412
15	1	15	19325	7363	38509	4551	8968	6521	2447	22119	3953
16	1	16	4203	1341	19714	2651	2991	1970	1121	4889	373
17	2	01									
18	2	02	73425	4965	30720	6484	7128	4791	2337	30261	0
19	2	03	23252	4782	26169	4726	4726	2366	1360	13758	0
20	2	04	3736	2460	18959	3006	3006	1653	1353	19550	0
21	2	05	3264	3021	26241	5687	7171	4894	2277	36190	36
22	2	06	3256	3316	23964	6083	6730	4907	1823	35011	395
23	2	07	7114	3219	23194	5453	5453	3651	1302	17340	0
24	2	08	28503	5567	33760	6734	6734	4466	2262	20212	0
25	2	09	32789	3621	23782	4191	4191	2466	1725	12515	0
26	2	10	5938	6135	28912	4805	5655	3670	1935	20987	205
27	2	11	24017	6959	31401	5753	5753	3652	2101	16971	0
28	2	12	5839	6168	40390	6911	6911	4804	2107	18301	0
29	2	13	3013	3352	22635	2980	4198	2769	1429	17033	0
30	2	14	5278	4963	25421	4167	4167	2564	1603	13409	0
31	2	15	11244	6537	29372	4066	4066	2250	1816	11779	0
32	2	16	29650	4111	29732	5028	5028	3041	1987	16309	0
33	2	17	3631	5095	28493	5140	6132	3831	2301	64505	0
34	2	18	41559	3553	26727	4208	4904	3127	1777	19672	297
35	2	19	24812	5778	32131	6072	6072	4136	1936	18240	0
36	2	20	4060	9466	44329	13918	13992	10559	3433	52804	0
37	2	21	4378	3856	25437	4056	4703	2953	1755	20711	0
38	2	22	4819	4909	25465	4289	4313	2650	1663	14073	38
39	2	23	4346	3733	21338	3029	5763	4250	1518	24313	0
40	2	24									
41	2	25	24886	3503	25546	3666	3666	2048	1618	26014	0
42	2	26	5204	4327	21489	3194	3194	1713	1481	26051	0
43	3	01	3904	2905	30066	5419	6081	4279	1202	24963	0
44	3	02	4475	3128	27557	4607	4654	2964	1690	15503	131
45	3	03	10763	4702	44359	6324	6365	3952	2413	23574	168
46	3	04	2409	2210	23567	3438	3438	2011	1477	11282	0
47	3	05	5347	4171	31862	5532	5590	3689	1891	13246	195
48	3	06	50694	5355	38137	6952	7092	4988	2104	15666	226
49	3	07	3346	4522	39354	8432	9536	7100	2436	43552	398
50	3	08									
51	3	09	1093	2046	20011	3805	3846	2673	1173	3624	141
52	3	10	3153	4033	50995	11050	11126	7395	3231	51471	0
53	3	11	4198	3710	46921	7301	7639	5263	2376	29393	392
54	3	12	5768	3881	44339	6531	6834	4557	2277	164169	337
55	3	13	5563	1676	23886	3422	3422	1988	1434	19001	0
56	3	14	670	3962	28185	4687	4736	3045	1691	12149	140
57	3	15	4023	2397	24509	3286	3286	1325	1461	13177	0
58	3	16	11271	5043	48647	3714	3761	6066	2695	27905	329
59	3	17	4145	4460	26707	5645	5645	3730	1915	21791	0
60	3	18	3271	4792	35985	6203	6256	4449	1207	19530	407

REDIT DATA7

LIST

1	1	01	5352	1137	69665					3361	18768
2	1	02	947	222	10712					288	334
3	1	03	1172	189	19287					710	3586
4	1	04	7210	1772	98725					4611	21272
5	1	05	22334	4171	350054					12386	33475
6	1	06	1034	280	9702					302	338
7	1	07	4248	397	68014					3065	19970
8	1	08	1444	352	15148					716	1730
9	1	09	1147	243	14754					1623	8445
10	1	10	831	216	11329					135	523
11	1	11	704	165	8245					347	278
12	1	12	0	0	0						
13	1	13	6886	1479	94860					3863	23591
14	1	14	0	0	9826					359	284
15	1	15	4718	1487	7485					4417	1087
16	1	16	0	0	2989					340	276
17	2	01	1188	294	8251	28	774	1559	4406		
18	2	02	2425	460	27390	5	719	1440	2848	0	0
19	2	03	1171	214	15831	3	506	1012	3137	0	0
20	2	04	910	160	12436	1	328	764	1413	0	0
21	2	05	1232	228	13427	6	520	1179	2011	360	1205
22	2	06	1136	221	17301	4	410	851	2309	647	2640
23	2	07	2320	451	20399	21	551	1339	2282	0	0
24	2	08	1459	306	22226	2	940	2030	7806	0	0
25	2	09	1126	349	15530	4	735	1327	6128	0	0
26	2	10	1533	387	22129	3	552	1210	2693	155	5725
27	2	11	2049	435	19635	3	851	1853	7190	0	0
28	2	12	1199	243	12509	10	832	1348	2295	0	0
29	2	13	1660	306	12172	4	474	1017	1652	0	0
30	2	14	1300	251	15576	2	490	1223	2081	0	0
31	2	15	1972	634	11882	1	574	1404	2010	0	0
32	2	16	1734	340	22064	6	844	1605	5362	0	0
33	2	17	1505	324	20996	4	451	908	2531	0	0
34	2	18	1712	392	13221	3	544	1067	3385	22	45
35	2	19	2120	441	20848	1	832	1917	3428	0	0
36	2	20	2225	492	17375	4	700	1412	2930	0	0
37	2	21	2148	415	14932	1	527	1265	2601	0	0
38	2	22	2208	423	17332	6	536	1315	2255	24	53
39	2	23	2070	402	12120	0	335	739	1340	0	0
40	2	24	1087	251	15849	11	915	1906	4765	0	0
41	2	25	936	145	12050	2	603	1166	4499	0	0
42	2	26	1226	228	10979	5	451	990	1863	0	0
43	3	01	1269	256	15892	123	553	1320	1600	0	0
44	3	02	1716	325	17336	7	434	977	1473	47	144
45	3	03	2186	417	20623	1	539	1047	3411	41	234
46	3	04	849	150	13039	12	402	937	1412	0	0
47	3	05	1785	345	18775	10	411	927	2012	43	162
48	3	06	1738	309	25300	27	308	1725	3277	140	1011
49	3	07	2934	508	30273	7	531	1005	1835	96	316
50	3	08	757	320	15373	42	436	825	1742		
51	3	09	0	0	12085	74	426	315	1241	41	1433
52	3	10	2044	432	16409	13	601	1363	2559	0	0
53	3	11	1597	312	19271	3	510	1103	2311	103	457
54	3	12	2064	416	22034	36	761	1331	2210	31	238
55	3	13	0	0	10715	4	321	658	1306	0	0
56	3	14	1584	323	22024	10	401	970	1590	49	143
57	3	15	1289	237	12972	11	326	713	1352	0	0
58	3	16	2297	447	20624	34	762	1596	3556	47	79
59	3	17	1965	334	16494	14	563	1225	2531	0	0
60	3	18	2132	412	14461	64	501	1016	1754	53	244

REDIT DATA
LIST

1	1	01	293	0	1583	4281	23153	6769	1363	4229	1117
2	1	02	0	165	251	1689	17324	3740	613	3753	533
3	1	03	72	71	123	643	3216	1343		1302	49
4	1	04	331	361	1370	5753	41372	10510	2740	6344	1324
5	1	05	502	0	1622	6646	28068	14537	2072	5769	2502
6	1	06	140	29	242	1463	16459	2474	655	1964	495
7	1	07	930	3222	1298	3403	26195	6953	4536	4646	1216
8	1	08	368	4774	570	1416	20643	4536	1295	3602	1037
9	1	09	643	421	399	3303	50707	4413	3198	10122	1331
10	1	10	233	0	535	3199	53453	5311	4936	10394	2400
11	1	11	227	933	320	1319	17003	2454	701	3222	687
12	1	12									
13	1	13	765	1220	1077	3555	26797	7309	1705	2905	1087
14	1	14	173	0	348	1763	17985	3135	761	2645	329
15	1	15	1133	3973	1419	3653					
16	1	16	157	0	239	715	14232	1144	142	2093	165
17	2	01					15556	3741	700	1503	239
18	2	02	399	0	644	1924	31384	5691	1312	4691	1220
19	2	03	36	0	490	1346	13193	4393	703	3032	531
20	2	04	236	413	361	1300	15140	2926	326	1753	743
21	2	05	357	595	529	1993	19337	5342	966	3006	1117
22	2	06	287	239	443	1416	17730	6539	440	1391	571
23	2	07	275	0	419	1314	13053	5117	433	2361	1041
24	2	08	333	0	1204	2986	13299	6164	567	3303	1019
25	2	09	535	14393	312	2535	17549	4134	632	3219	700
26	2	10	716	639	1102	2765	13913	4136	434	2729	1014
27	2	11	42	21673	1549	5116	16369	5250	505	3357	626
28	2	12	116	1976	1335	4637	43658	5265	3405	3910	1351
29	2	13	152	1716	309	2523	15973	2636	723	1950	723
30	2	14	40	3077	1072	4743	17993	4071	472	4143	913
31	2	15	0	2455	1364	4399	17528	3573	621	2635	739
32	2	16	329	1940	1297	3416	4032	4725	625	2520	623
33	2	17	261	0	446	2301	32543	4446	356	2675	764
34	2	18	344	354	596	2571	17469	3902	504	3040	1264
35	2	19	1097	3506	1536	3736	16562	6194	625	3214	1296
36	2	20	1023	0	1660	3614	46679	11999	1754	6034	1997
37	2	21	306	0	733	2333	15994	3321	531	2976	1197
38	2	22	0	230	1072	2503	15301	4095	461	2053	737
39	2	23	127	0	933	2506					
40	2	24	711	11337	1372	6357	39222	4317	1439	3654	1053
41	2	25	361	662	639	2703	22900	3435	392	3473	1104
42	2	26	0	0	659	2795	13714	3560	554	2610	730
43	3	01	274	0	433	2952	26254	5442	907	3176	1126
44	3	02	336	0	471	1693	15501	4152	398	2695	532
45	3	03	330	0	532	3567	22370	5596	1637	4239	750
46	3	04	134	400	311	1634	16166	3205	442	3062	1022
47	3	05	423	1400	530	3091	14731	5097	471	3501	437
48	3	06	644	4000	363	4057	26333	5932	1222	4415	1539
49	3	07	0	2300	425	3305	23013	5163	950	3643	1055
50	3	08					19064	1990	922	4297	450
51	3	09	51	5500	212	1453	14720	3336		2323	734
52	3	10	43	3600	1033	6043	44576	9513	1962	5933	1673
53	3	11	393	4100	673	3513	26935	7024	1177	4977	2007
54	3	12	103	300	495	4042	25399	5442	993	4023	1379
55	3	13	14	100	203	1352	16043	3022	679	2963	945
56	3	14	56	0	692	2542	16140	4342	422	3297	502
57	3	15	0	900	292	1313	13636	3253	503	5100	572
58	3	16	326	4700	720	3733	33396	3454	1264	5952	1759
59	3	17	20	1000	565	3532	13162	5529	579	3152	436
60	3	18	143	400	550	5314	22313	5921	593	4273	1111

!EDIT DATA9

LIST

1	1	2958	0
2	2	338	1
3	3	339	0
4	4	5002	0
5	5	14725	0
6	6	353	1
7	7	3392	0
8	8	305	1
9	9	1790	0
10	10	155	1
11	11	395	1
12	12	0	0
13	13	4404	1
14	14	436	1
15	15	4828	0
16	16	385	1
17	17	0	0
18	18	0	0
19	19	0	0
20	20	0	0
21	21	0	0
22	22	0	0
23	23	0	0
24	24	0	1
25	25	0	1
26	26	0	0
27	27	0	1
28	28	0	0
29	29	0	0
30	30	0	0
31	31	0	0
32	32	0	1
33	33	0	0
34	34	88	1
35	35	0	1
36	36	0	0
37	37	0	0
38	38	0	0
39	39	0	0
40	40	0	0
41	41	0	1
42	42	0	0
43	43	0	0
44	44	0	0
45	45	0	0
46	46	0	0
47	47	0	0
48	48	0	0
49	49	71	0
50	50	0	0
51	51	0	0
52	52	0	0
53	53	0	0
54	54	0	0
55	55	0	0
56	56	0	0
57	57	0	0
58	58	0	0
59	59	0	0
60	60	0	0

!EDIT DATA10

LIST

1	0	0
2	55579	2190
3	0	0
4	1327	451
5	0	0
6	54588	2080
7	0	0
8	12584	3431
9	3565	123
10	31812	1444
11	55606	2339
12	0	0
13	36250	1280
14	60233	2553
15	11306	13
16	56473	2150
17	1640	1110
18	6911	4561
19	4549	1927
20	1193	2611
21	3687	6725
22	7389	6470
23	10766	4477
24	3099	4216
25	1579	14
26	4138	3196
27	2273	2740
28	4311	3062
29	4637	2483
30	4566	3497
31	1572	3194
32	2059	64
33	2946	3923
34	4144	1334
35	4360	3237
36	6591	3901
37	2124	1652
38	4407	2862
39	5991	1527
40	486	7
41	704	6
42	1197	2691
43	13577	1368
44	5212	2053
45	17626	1937
46	8232	1031
47	16938	3673
48	38144	3489
49	15653	423
50	2179	16
51	3382	473
52	16958	3031
53	28058	4880
54	11894	2379
55	9614	2229
56	6195	2235
57	12417	1165
58	30087	3957
59	11166	4845
60	17905	2747

!EDIT DATA11

LIST

11	2	353	1390
12	1	238	1015
13	0	32	377
14	5	419	1816
15	105	673	2771
16	2	205	950
17	5	304	1582
18	4	459	2894
19	9	347	1796
20	4	347	2076
21	1	222	944
22	11	251	1247
23	4	344	1513
24	1	247	1330
25	-1	-1	-1
26	2	205	672
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	0
36	0	0	0
37	0	0	0
38	0	0	0
39	0	0	0
40	0	0	0
41	0	0	0
42	0	0	0
43	0	0	0
44	0	0	0
45	0	0	0
46	0	0	0
47	0	0	0
48	0	0	0
49	0	0	0
50	0	0	0
51	0	0	0
52	0	0	0
53	0	0	0
54	0	0	0
55	0	0	0
56	0	0	0
57	0	0	0
58	0	0	0
59	0	0	0
60	0	0	0
61	0	0	0
62	0	0	0
63	0	0	0
64	0	0	0
65	0	0	0
66	0	0	0
67	0	0	0
68	0	0	0
69	0	0	0
70	0	0	0

APPENDIX C

MISSION DATA AND ANALYSIS PROGRAMS

This appendix documents the mission data that were analyzed using the Statistical Package for the Social Sciences (SPSS) system of computer programs.

Using SPSS, files "MSN2" through "MSN8" were designated containing the mission capability and workload data analyzed. Files "STAT6" through "STAT12" were designated containing the specific statistical analysis programs, the FORTRAN format statements, and variable identification. The following list identifies the relationships that were developed using SPSS.

<u>Mission/Support Workload Relationship</u>	<u>Statistical Analysis Program</u>	<u>Data File</u>
SAC Aircraft/Mission Program Element Manpower	STAT6	MSN2
TAC Aircraft/Mission Program Element Manpower	STAT9	MSN5
ATC Pilot and Navigator Student Workload/Mission Program Element Manpower	STAT12	MSN7
ATC Technician, Crypto-Intelligence, Recruit, Cadet, and Professional Education Training Workload/Mission Program Element Manpower	STAT11	MSN8
SAC Aircraft and Missiles/Total Item Records	STAT7	MSN3
TAC Aircraft/Total Item Records	STAT8	MSN4
ATC Training Workload/Total Item Records	STAT10	MSN6

The identified statistical analysis programs and associated data files are reproduced on the succeeding pages of this appendix.

!EDIT STAT5

```

*LIST
1      FILE NAME      SAC MISSION ANALYSIS
2      VARIABLE LIST   B52D,B52G,B52H,FB111,SPAM,MPMR2,KC135A,KC13
50
3      INPUT MEDIUM   DISK
4      INPUT FORMAT    FIXED(F2.0,F5.0,4F3.0,2F4.0,2F3.0)
4.5    COMMENT         DATA IS CONTAINED IN MSN2
5      N OF CASES      UNKNOWN
6      MISSING VALUES B52D,B52G,B52H,FB111,MPMR1,MPMR2,SPAM,KC135A,KC1350(-1)
6.5    IF              (BASE EQ 29) D1=1
7      COMPUTE         B52=B52G+B52H
8      REGRESSION       VARIABLES=MPMR1,B52D,B52G,B52H,FB111,SPAM,
9                      MPMR2,KC135A,KC1350,B52,D1/
10     REGRESSION=MPMR1 WITH B52D,B52G,B52H,FB111,D1(2)/
11     REGRESSION=MPMR2 WITH KC135A,KC1350,D1(2)/
12     OPTIONS          2
13     READ INPUT DATA
14     FINISH

```

!EDIT STAT7

```

*LIST
10     FILE NAME      JTRC,TENANT,B52,KC135,MINMAN,TITAN,RICK,E4A,EC135,
11     VARIABLE LIST   F106,F111,BEAL
11.5    COMMENT         DATA IS CONTAINED IN MSN3
12     INPUT MEDIUM   DISK
13     INPUT FORMAT    FIXED(2F5.0,10F2.0)
13.5    COMMENT         DATA IS CONTAINED IN MSN3
14     N OF CASES      UNKNOWN
15     REGRESSION       VARIABLES=JTRC,TENANT,B52,KC135,MINMAN,TITAN,RICK,
16                     E4A,EC135,F106,F111,BEAL/
17     REGRESSION=JTRC WITH TENANT,B52,KC135,MINMAN,TITAN,
18                     RICK,E4A,F106,F111,BEAL(2) RESID=0/
18.5    STATISTICS     2.4
19     READ INPUT DATA
20     FINISH

```

!EDIT STAT8

```

*LIST
10     FILE NAME      TAC ITEM RECORD ANALYSIS
11     VARIABLE LIST   JTRC,TENANT,F4,F15,F111,RF4,A7,A10,F105,F5,EC135,HOW,
HURL
12     INPUT MEDIUM   DISK
13     INPUT FORMAT    FIXED(2F5.0,11F2.0)
13.5    COMMENT         DATA IS CONTAINED IN MSN4
14     N OF CASES      UNKNOWN
15     REGRESSION       VARIABLES=JTRC,TENANT,F4,F15,F111,RF4,A7,A10,F105,F5,
16                     EC135,HOW,HURL/
17     REGRESSION=JTRC WITH TENANT(7),F4,F15,F111,RF4,A10(6)
17.4    REGRESSION=JTRC WITH TENANT,F4,F15,F111,RF4,A10(5) RE
SID=0/
18     STATISTICS     2.4
19     READ INPUT DATA
20     FINISH

```

!EDIT STAT9

```

*LIST
10     FILE NAME      TAC MISSION MANPOWER ANALYSIS
11     VARIABLE LIST   MPMR,A7,A10,F4,F5,F15,F111,RF4,F105,Q2,QV10A,EC135P,LU
KE
12     INPUT MEDIUM   DISK
13     INPUT FORMAT    FIXED(F4.0,12F3.0)
13.5    COMMENT         DATA IS CONTAINED IN MSN5
14     N OF CASES      UNKNOWN
15     REGRESSION       VARIABLES=MPMR,A7,A10,F4,F5,F15,F111,RF4,F105,Q2,QV10A,
16                     EC135P,LUKE/
17     REGRESSION=MPMR WITH A7,A10,F4,F5,F111,F15,RF4,F105,
18                     Q2,QV10A,EC135P,LUKE(2)/
18.5    STATISTICS     2
19     READ INPUT DATA
20     FINISH

```

STAT10

```

10   FILE NAME      ATC ITEM RECORD ANALYSIS
10.5 PRINT BACK     NO
11   VARIABLE LIST  ITREC,URT,TENPOP,RALA,MATH,STUD,KS
12   INPUT MEDIUM  DISK
13   INPUT FORMAT   FIXED(1X,F4.0,F2.0,F5.0,F2.0,F2.0,F6.0,F2.0)
14   COMMENT        DATA IS CONTAINED IN MSN6
15   N OF CASES     UNKNOWN
16   REGRESSION      VARIABLES=ITREC,URT,TENPOP,RALA,MATH,STUD,KS/
17                   REGRESSION=ITREC WITH URT,TENPOP,RALA,MATH,STUD,KS(1)/
18   STATISTICS      2
19   READ INPUT DATA
20   FINISH

```

STAT11

```

1   FILE NAME      ATC MISSION ANALYSIS
2   PRINT BACK     NO
3   VARIABLE LIST  Y,X1,X2,X3,X4,X5
4   INPUT MEDIUM  DISK
5   INPUT FORMAT   FIXED(6F5.0)
6   COMMENT        DATA IS CONTAINED IN MSN8
7   N OF CASES     UNKNOWN
8   REGRESSION      VARIABLES = Y,X1,X2,X3,X4,X5/
9                   REGRESSION=Y WITH X1,X2,X3,X4,X5(2)/
10  STATISTICS      2
11  READ INPUT DATA
12  FINISH

```

STAT12

```

1   FILE NAME      ATC MISSION ANALYSIS
2   PRINT BACK     NO
3   VARIABLE LIST  Y,X1,X2,X3
4   INPUT MEDIUM  DISK
5   INPUT FORMAT   FIXED(4F5.0)
6   COMMENT        DATA IS CONTAINED IN MSN7
7   N OF CASES     UNKNOWN
8   REGRESSION      VARIABLES = Y,X1,X2,X3/
9                   REGRESSION=Y WITH X1,X2,X3(1)/
10  STATISTICS      2
11  READ INPUT DATA
12  FINISH

```

!EDIT MSN2
CLIST

1	01	1158	14	0	0	0	0	-1	-1	-1
2	02	1487	0	30	0	0	135	496	19	0
3	03	-1	-1	-1	-1	-1	-1	750	0	30
4	04	925	0	16	0	0	116	330	14	0
5	05	1998	33	0	0	0	0	400	16	0
6	07	1033	14	0	0	0	0	303	16	0
7	08	1569	0	0	30	0	167	267	9	0
9	10	995	0	16	0	0	119	705	29	0
10	11	1094	0	0	17	0	134	420	20	0
11	12	1030	0	16	0	0	117	331	16	0
12	13	-1	-1	-1	-1	-1	-1	812	40	0
13	14	1198	0	0	20	0	138	413	20	0
14	15	1053	0	14	0	0	113	646	30	0
15	17	1015	14	0	0	0	0	325	21	0
16	18	-1	-1	-1	-1	-1	-1	745	19	0
17	19	1075	0	0	17	0	127	-1	-1	-1
18	21	1291	0	0	0	26	61	353	20	0
19	22	1650	0	0	0	21	69	537	10	20
20	26	942	0	16	0	0	115	360	16	0
21	27	698	0	15	0	0	111	319	14	0
22	28	999	0	15	0	0	107	303	21	0
23	29	1864	0	12	6	0	-11480	41	0	0

!EDIT MSN3
CLIST

10	10397	3151	1	1	0	0	0	0	0	1	0	0
11	10072	3264	0	0	0	0	0	0	1	0	0	0
12	9217	1376	1	1	1	0	0	0	0	0	0	0
13	8459	854	1	1	0	0	0	0	0	0	0	0
14	7915	304	1	1	0	0	0	0	0	0	0	0
15	7737	565	1	1	1	0	0	0	1	0	0	0
16	7631	976	1	1	0	0	0	0	0	0	0	0
17	7648	990	1	1	0	0	0	0	0	0	0	0
18	7574	773	1	1	0	0	0	0	0	1	0	0
19	7444	458	1	1	1	0	0	0	0	0	0	0
20	7107	2240	1	1	0	0	0	0	0	0	0	0
21	6988	565	0	1	0	0	0	0	0	0	1	0
22	6774	1033	1	1	0	0	0	0	0	0	0	0
23	6738	702	1	1	0	0	0	0	0	0	0	0
24	6709	3534	0	0	0	0	0	0	0	0	0	0
25	6348	343	1	1	0	0	0	0	0	0	0	0
26	6295	496	0	1	0	0	0	0	0	0	1	0
27	5820	398	0	1	0	0	0	0	0	0	0	1
28	5744	288	1	1	0	0	0	0	0	0	0	0
29	5496	279	1	1	0	0	0	0	0	0	0	0
30	5477	418	0	1	0	1	0	0	0	0	0	0
31	5293	1096	0	0	1	0	0	0	0	0	0	0
32	4628	526	0	1	0	0	0	0	1	0	0	0
33	4226	573	0	0	0	0	1	0	0	0	0	0
34	4122	471	0	0	1	0	0	0	0	0	0	0
35	3611	466	0	0	1	0	0	0	0	0	0	0

!EDIT MSN4
CLIST

10	12844	1309	1	1	0	0	0	0	0	1	0	0	0
11	11431	1162	0	1	0	0	0	0	0	0	0	0	0
12	11272	1728	0	1	0	0	0	0	0	0	1	0	0
13	10833	1470	1	1	0	0	0	0	0	0	0	0	0
14	9791	1289	1	0	0	0	0	0	0	0	0	0	0
15	9719	1277	1	0	0	0	0	0	0	0	0	0	0
16	9600	2115	0	0	0	0	0	1	0	0	0	0	0
17	9243	1607	1	0	0	0	0	0	0	0	0	0	0
18	8784	474	0	0	0	1	0	0	0	0	0	0	0
19	8722	535	0	0	0	1	0	0	0	0	0	0	0
20	8371	451	1	0	0	0	0	0	1	0	0	0	0
21	6955	192	0	0	1	0	0	0	0	0	0	0	0
22	6571	340	0	0	1	0	0	0	0	0	0	0	0
23	6044	351	0	0	0	0	0	1	0	0	0	0	0
24	5421	531	0	0	0	0	0	0	0	0	0	1	0
25	5376	291	0	0	0	0	0	0	0	0	0	0	1
26	5037	367	1	0	0	0	0	0	0	0	0	0	0
27	4904	340	0	0	0	0	1	0	0	0	0	0	0

REDIT MSG5

LIST

10	1275	0	0	0	0	0	0	36	0	0	0	0	0
11	1153	0	0	0	0	0	0	0	0	22	11	0	0
12	2557	0	0	0	0	0	0	78	0	0	0	0	0
13	1070	0	52	0	0	0	0	0	0	0	0	0	0
14	354	0	0	0	0	0	0	0	0	24	0	0	0
15	1685	72	0	0	0	0	0	0	0	0	0	0	0
16	2650	0	0	38	0	0	0	0	0	0	0	0	0
17	486	0	0	0	0	0	0	0	0	23	0	0	0
18	3188	0	0	0	0	66	0	0	0	0	0	0	0
19	2439	0	0	96	0	0	0	0	0	0	0	0	0
20	332	0	0	0	0	0	0	0	0	0	0	3	0
21	2900	0	0	0	0	66	0	0	0	0	0	0	0
22	3421	0	0	55	0	82	0	0	0	0	0	0	1
23	2217	0	0	78	0	0	0	0	0	0	0	0	0
24	1697	0	0	54	0	0	0	0	0	0	0	0	0
25	2666	0	0	0	0	0	84	0	0	0	0	0	0
26	1348	0	60	0	0	0	0	0	0	0	0	0	0
27	1288	0	6	24	0	14	0	0	0	0	0	0	0
28	657	0	0	0	44	0	0	0	0	0	0	0	0
29	1978	0	0	72	0	0	0	0	0	0	0	0	0
30	2114	0	0	0	0	0	0	96	0	0	0	0	0
31	935	0	0	0	0	0	0	0	0	33	0	0	0
32	1796	0	0	60	0	0	0	0	0	0	0	0	0

REDIT MSG6

LIST

10	5008	0	247	0	0	4818	0
11	4371	1	326	0	0	338	0
12	9572	0	1866	0	0	6029	1
13	2918	0	4179	1	0	15417	0
14	4208	1	215	0	0	364	0
15	6603	0	3526	0	0	4473	0
16	9022	1	1940	0	1	762	0
17	4293	0	458	0	0	1569	0
18	5574	1	2945	0	0	195	0
19	4598	1	179	0	0	343	0
20	6662	0	352	0	0	5320	0
31	6163	1	296	0	0	368	0
22	4856	0	171	0	0	4499	0

REDIT MSG7

LIST

10	821	170	0	1
11	725	164	0	1
12	926	96	0	0
13	1197	152	0	0
14	1173	169	0	0
15	1010	0	12	0

REDIT MSG8

LIST

10	1320	4818	0	0	0	0
11	1836	4473	0	0	0	0
12	1873	5090	0	0	0	0
13	2152	6089	0	0	0	0
14	1007	4721	0	0	0	0
15	394	0	672	0	0	0
16	1207	0	0	9876	0	0
17	3958	0	0	0	4499	0
18	765	0	0	0	0	1569

APPENDIX D

PROGRAM AND SUBROUTINE DOCUMENTATION

This appendix documents the programs that comprise the GEBOS-M model. Program names appear below:

BOSPG
BOSTST
LPSUB
MATGEN
MISSUB
NBOSPG
RAWIA
REITA
RIVO
SUBLP

The GEBOS-M model design is detailed in Section 5 of this report, which includes summary program descriptions. Program listings are detailed in Annex 1 to this appendix.

The major input and output variables employed in the principal GEBOS-M programs are explained in Annex 2 to this appendix.

ANNEX 1
PROGRAM LISTINGS

BOSPG

```

20.  INTEGER CMDS,CMO
40.  DOUBLE PRECISION DASH,FNAM,CNAM,FILES,FILE,MP,WNAMS
60.  DIMENSION OBEY(4),OBEY(4),OBEYX(4),OBEY(4)
80.  DIMENSION TOT(3),CMO(3),FILES(3)
100.  DIMENSION PCIMIL(50),XMPCNT(50),XPCNT(50),XTOT(3),XPR(50,3),XMIL(50,3),WTND(50,50),WNS(50),CONST(50)
120.  DIMENSION X(75),XBAR(50),DELX(50),C(50,50),MPIND(50),IFUNCS(50),CSUMY(50),MOMIT(50),OBJ2(50)
140.  DIMENSION RHS(50),OBJ(50),C2(50,50),RHS2(50),X2(75)
160.  DIMENSION FUNC(50),FNAM(50,8),CIAM(8),MP(50,8),WNAMS(50,8)
180.  DATA OBEY //EQUATE 2 TOTSEL//
200.  DATA OBEYX //EQUATE 3 BOSLST//
220.  DATA OBEY //EQUATE 1 ROSTMP//
240.  DATA FILES //ATCFL,'SACFL','TACFL'/
260.  DATA DASH //*****//
280.  ** MAIN POWER TOTAL FOR EACH COMMAND WILL NOW BE ENTERED FROM TOTSEL.
300.  CALL OBEY(OBEYX,4)
320.  READ(2,*)(TOT(K),K=1,3)
340.  REMIND 2
360.  CALL OBEY(OBEYX,4)
380.  CALL OBEY(OBEYX,4)
400.  LOOP=2
420.  WRITE(6,9000)(DASH,K=1,16)
440.  9000 FORMAT(16A5//24X,'AIR FORCE BASE OPERATING SUPPORT',//X
460.  23X,'AGGREGATE WORKLOAD INDICATOR MODEL')
480.  10 CONTINUE
500.  WRITE(6,9010)(DASH,K=1,16)
520.  9010 FORMAT(//16A5//)
540.  IF(LOOP.FO.1)GO TO 55
560.  *LOOP EQUALS 114 WHEN CHANGES ARE ACCUMULATED.
580.  *THE COMMAND(S) REMAIN THE SAME.
600.  WRITE(6,9020)
620.  9020 FORMAT(//1X,'ENTER COMMANDS (1=ATC,2=SAC,3=TAC):')
640.  20 CONTINUE
660.  READ(5,9030)(CMD(K),K=1,3)
680.  9030 FORMAT(11,1X,11,1X,11)
700.  CMDS=0
720.  DO 30 K=1,3
740.  IF(CMD(K).EQ.0)GO TO 30
760.  IF(CMD(K).LT.1.OR.CMD(K).GT.3)GO TO 35
780.  CMDS=CMDS+1
800.  30 CONTINUE
820.  IF(CMDS.GT.0)GO TO 40
840.  35 CONTINUE
860.  *RITF(6,9040)
880.  9040 FORMAT(//1X,'INVALID--ENTER 1,2, OR 3:')
900.  GO TO 20
920.  40 CONTINUE
940.  ** A VALID COMMAND HAS BEEN ENTERED.
960.  *CMO EQUALS THE NUMBER OF COMMANDS BEING CHANGED.
980.  *THE TOTAL MAIN POWER IS NOW COMPUTED (ALL COMMANDS).
1000.  TOTSEL=0
1020.  DO 50 K=1,CMDS
1040.  TOTSEL=TOTSEL+TOT(CMD(K))
1060.  50 CONTINUE
1080.

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1100. 55 CONTINUE
1120. *A LOOP IS SET UP TO RUN THROUGH DATA INPUT, CHANGE, AND PRINT
1140. *PROCEDURES FOR EACH COMMAND.
1160. DO 760 ICHT=1,CMDS
1180. *INITIALIZATION OF VARIABLES FOLLOWS.
1200. DO 60 K=1,50
1220. DELX(K)=0
1240. IFUNC(S(K))=0
1260. 60 CONTINUE
1280. BASES=0
1300. ILOPT=0
1320. MFUNC=0
1340. IF(L.OOP.FQ.2)GO TO 80
1360. DO 70 J=1,N
1380. XBAR(J)=X(J)
1400. 70 CONTINUE
1420. GO TO 165
1440. 80 CONTINUE
1460. *THE INPUT FILE WILL NOW BE DETERMINED: ATCFL, SACFL, OR IACFL.
1480. FILE=FILES(CMO(1CINT))
1500. ENCODE(OREYV,9050)FILE
1520. CALL OREY(OREYV,4)
1540. 9050 FORMAT(10H'EQUATE 2 ,A5)
1560. *THE NX VALUES, COEFFICIENTS, AND FUNCTION AND WORKLOAD INDICATOR TITLES
1580. *UNTIL NOW BE ENTERED. THE NY VALUES WILL BE COMPUTED FROM THE NX VALUES.
1600. READ(2,*)XBASES,CSUM
1620. READ(2,9070)(CNAM(K),K=1,8)
1640. 9070 FORMAT(11X,BAS)
1660. READ(2,*)M,N,M2,ARG,N2,N3,M3,M4
1680. DO 85 J=1,N
1700. READ(2,*)XBAR(J)
1720. 85 CONTINUE
1740. DO 90 I=1,M
1760. READ(2,*)FUNC(I),PCTMIL(I),CSUMY(I)
1780. READ(2,9070)(FNAME(I,K),K=1,8)
1800. 90 CONTINUE
1820. READ(2,*)(ORJ(J),J=1,N)
1840. ORJ2(N+1)=1
1860. READ(2,*)(RHS(I),I=1,M2)
1880. *PI=PI+1
1900. *PA=2*M
1920. N4=MP*PI
1940. DO 95 I=1,M2
1960. READ(2,*)(C(I,J),J=1,N)
1980. C2(I,N+1)=0
2000. 95 CONTINUE
2020. C2(1,N+1)=1
2040. IF(M3.GT.0) READ(2,*)(WOMIT(I),I=1,M3)
2060. GO 140 J=1,M2
2080. READ(2,*)MPIND(J)
2100. READ(2,9070)(MP(J,K),K=1,8)
2120. 140 CONTINUE
2140. *THE ARRAY MP CONTAINS TITLES FOR CHANGEABLE WORKLOAD INDICATORS.
2160. DO 160 J=1,N3

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2180. READ(2,*)MIS(J)
2200. IF(MIS(J).EQ.0)GO TO 150
2220. READ(2,*)MIND(J,K)K=1,N)CONST(J)
2240. 150 CONTINUE
2260. READ(2,9070)(WNAMS(J,K)K=1,A)
2280. 160 CONTINUE
2300. *THE ARRAY WNAMS CONTAINS TITLES FOR THE PRINTED WORKLOAD INDICATORS.
2320. *IF MIS(J) EQUALS ZERO, THE TITLE IS A HEADER OR A SKIPPED LINE.
2340. *THE ARRAY MIND INDICATES THE COMBINATION OF THE ACTUAL WORKLOAD INDICATORS
2360. *WHICH THE PRINTED LINE REPRESENTS.
2380. RE*IND 2
2400. 165 CONTINUE
2420. SUMY=0
2440. DO 167 I=1,M
2460. SUMY=SUMY+XBAR(I)
2480. 167 CONTINUE
2500. RMS(I)=SUMY
2520. IF(CMDS.FQ.1)TOTIS=SUMY
2540. YANT=0
2560. USAGE=0
2580. IF(CMDS.FQ.1)GO TO 170
2600. *SPECIAL PROVISIONS MUST BE MADE FOR THE CHANGE OF MORE THAN 1 COMMAND:
2620. *FIRST, ONLY AN ABSOLUTE CHANGE MAY BE MADE, TO BE APPORTIONED TO ALL FUNCTIONS;
2640. *SECOND, NO WORKLOAD INDICATORS MAY BE CHANGED DIRECTLY;
2660. *THIRD, NO CHANGE IN THE NUMBER OF BASES MAY BE SPECIFIED;
2680. *FOURTH, NO ACCUMULATION OF CHANGES IS ALLOWED.
2700. IF(ICNT.FQ.1)GO TO 210
2720. *ON THE FIRST ITERATION OF THE ICNT LOOP, THE ABSOLUTE CHANGE WILL BE SPECIFIED.
2740. *ON SUCCESSIVE ITERATIONS, THE SAME CHANGE IS APPLIED;
2760. *A PRINTOUT, BUT NO CHANGE OPTIONS, IS GIVEN.
2780. GO TO 398
2800. 170 CONTINUE
2820. *WRITE(6,9080)
2840. 9080 FORMAT(/1X,'ENTER CHANGE OPTION (1=MANPOWER,2=WORKLOAD):')
2860. 180 CONTINUE
2880. READ(5,*)ICOPT
2900. GO TO (190,500),ICOPT
2920. *WRITE(6,9090)
2940. 9090 FORMAT(/1X,'INVALID--ENTER 1 OR 2:')
2960. GO TO 180
2980. 190 CONTINUE
3000. *WRITE(6,9100)
3020. 9100 FORMAT(/1X,'ENTER TYPE OF CHANGE SPEC. (1=ABSOLUTE,2=PERCENT,3=NO OVERALL CHANGE SPEC.):')
3040. 200 CONTINUE
3060. READ(5,*)ICOPT
3080. GO TO (210,240,260),ICOPT
3100. *WRITE(6,9040)
3120. GO TO 200
3140. 210 CONTINUE
3160. *WRITE(6,9120)
3180. 9120 FORMAT(/1X,'ENTER ABSOLUTE CHANGE:')
3200. 220 CONTINUE
3220. READ(5,*)ABSCHG
3240. IF(TOTS+ABSCHG.GE.0)GO TO 230

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3260. *RTF(6,9130)
3280. 9130 FORMAT(/1X,'INVALID'--CAUSES A NEGATIVE RESULTANT MANPOWER; RE-ENTER;')
3300. GO TO 220
3320. 230 CONTINUE
3340. PRNT=ABSCHG/TOTS
3360. *AFTER A VALID CHANGE IS ENTERED, IT IS CONVERTED TO A PERCENT FOR COMPUTATIONS.
3380. IF(CMS.GT.1)GO TO 398
3400. GO TO 260
3420. 240 CONTINUE
3440. *RTF(6,9140)
3460. 9140 FORMAT(/1X,'ENTER PERCENT CHANGE;')
3480. 250 CONTINUE
3500. READ(5,*)PRNT
3520. IF(PRNT.GE.-100.)GO TO 255
3540. *RTF(6,9130)
3560. GO TO 250
3580. 255 CONTINUE
3600. PRNT=PRNT/100.
3620. 260 CONTINUE
3640. *RTF(6,9150)
3660. 9150 FORMAT(/1X,'ENTER THE NUMBER OF FUNCTIONS FOR WHICH CHANGES WILL BE SPECIFIED;')
3680. 270 CONTINUE
3700. READ(5,*)NFUNC
3720. IF(NFUNC.GT.0.AND.NFUNC.LE.4)GO TO 280
3740. IF(NFUNC.EQ.1)GO TO 360
3760. *WHEN NO FUNCTIONS ARE SPECIFIED, THE CHANGE IS APPORTIONED TO ALL FUNCTIONS.
3780. *RTF(6,9160)M
3800. 9160 FORMAT(/1X,'INVALID'--ENTER FROM 1 TO 12;')
3820. GO TO 270
3840. 280 CONTINUE
3860. *RTF(6,9170)
3880. IF((COPT.NE.3)*RTF(6,9175)
3900. *RTF(6,9176)
3920. 9170 FORMAT(/1X,'ENTER METHOD BY WHICH FUNCTION CHANGES WILL BE SPECIFIED AS FOLLOWS;')
3940. 4X,'1=ABSOLUTE NUMBER OF PEOPLE;/'
3960. 4X,'2=PERCENT OF FUNCTION MANPOWER;/'
3980. 4X,'3=PERCENT OF BOS MANPOWER;/'
4000. 4X,'4=PERCENT OF TOTAL CHANGE;/'
4020. 9175 FORMAT(4X,'METHOD:')
4040. 290 READ(5,*)METH
4060. IF((COPT.EQ.3)GO TO 295
4080. IF(METH.GT.0.AND.METH.LT.5)GO TO 300
4100. *RTF(6,9180)
4120. 9180 FORMAT(/1X,'INVALID'--ENTER 1,2,3, OR 4;')
4140. GO TO 290
4160. 295 CONTINUE
4180. IF(METH.GT.0.AND.METH.LT.4)GO TO 300
4200. *RTF(6,9040)
4220. GO TO 290
4240. 300 CONTINUE
4260. *RTF(6,9190)
4280. 9190 FORMAT(/1X,'ENTER FUNCTIONS AND ASSOCIATED CHANGES (ONE FUNCTION PER LINE);/'
4300. 1X,'USING THE FOLLOWING NUMBERS TO DENOTE FUNCTIONS;')
4320. DC 310 I=1,M

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4340.      *RITE(6,9200)I,(FNAM(I,K),K=1,8)
4350.      9200 FORMAT(3X,12,'E',8A5)
4360.      310 CONTINUE
4370.      WRITE(6,9210)
4380.      9210 FORMAT(/)
4390.      DO 350 I=1,NFUNC
4400.      *RITE(6,9220)
4410.      9220 FORMAT(1X,'FUNCTION CHANGE:')
4420.      320 CONTINUE
4430.      READ(5,*)IFUNCS(I),AMOUNT
4440.      IF(1,IFUNCS(I),GT.0.AND.1,IFUNCS(I),LE.N)GO TO 330
4450.      *RITE(6,9230)
4460.      9230 FORMAT(1X,'INVALID FUNCTION--RE-ENTER FUNCTION AND CHANGE:')
4470.      GO TO 320
4480.      330 CONTINUE
4490.      IF(METH.FQ.1)DELY=AMOUNT
4500.      IF(METH.FQ.2)DELY=AMOUNT*XBAR(IFUNCS(I))/100.
4510.      IF(METH.FQ.3)DELY=AMOUNT*SUMP/100.
4520.      IF(METH.FQ.4)DELY=AMOUNT*PRCHT*SUMP/100.
4530.      *CHANGE IN XPL IS COMPUTED USING METHOD OF CHANGE CHOSEN PREVIOUSLY.
4540.      IF(1,DELY*XBAR(IFUNCS(I)),GE.0)GO TO 340
4550.      *RITE(6,9240)
4560.      9240 FORMAT(1X,'INVALID CHANGE--NEGATIVE RESULTANT MANPOWER! RE-ENTER FUNCTION AND CHANGE:')
4570.      GO TO 320
4580.      340 CONTINUE
4590.      USAGE=USAGE+DELY
4600.      YAMT=YAMT+XBAR(IFUNCS(I))
4610.      X(IFUNCS(I))=XBAR(IFUNCS(I))+DELY
4620.      350 CONTINUE
4630.      360 CONTINUE
4640.      *RITE(6,9250)
4650.      9250 FORMAT(1X,'IS THERE A CHANGE IN THE NUMBER OF BASES (1=YES,2=NO)?')
4660.      370 CONTINUE
4670.      READ(5,*)IOPT
4680.      GO TO (380,398),IOPT
4690.      *RITE(6,9090)
4700.      GO TO 370
4710.      380 CONTINUE
4720.      *RITE(6,9270)
4730.      9270 FORMAT(1X,'ENTER NUMBER OF BASES TO BE OPENED(+) OR CLOSED(-):')
4740.      READ(5,*)BASES
4750.      DO 390 I=2,NPI
4760.      IF(C(I,I-1).NE.0) RHS(I)=RHS(I)+BASES*CSUMP(I-1)/C(I,I-1)
4770.      390 CONTINUE
4780.      395 CONTINUE
4790.      *BARGE0
4800.      *2*H0=H2
4810.      *H0=H1
4820.      IF(1,COPT.NE.3)GO TO 399
4830.      *H0=H1
4840.      IF(YAMT.FQ.0)GO TO 400
4850.      IF(USAGE/YAMT-GT.0)RHS(1)=RHS(1)+2*USAGE/YAMT*RHS(1)
4860.      GO TO 400
4870.      399 CONTINUE

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5420.  RHS(1)=RHS(1)+PRCNT*SUMY
5440.  400 CONTINUE
5460.  DO 401 J=1,N
5480.  OBJ2(J)=OBJ(J)
5500.  401 CONTINUE
5520.  IF(.IFUNC.EQ.0)GO TO 404
5540.  402 CONTINUE
5560.  DO 403 J=1,NFUNC
5580.  OBJ2(IFUNCS(J))=0
5600.  403 CONTINUE
5620.  404 CONTINUE
5640.  DO 415 I=1,M2ARG
5660.  DO 405 J=1,N
5680.  C2(I,J)=C(I,J)
5700.  405 CONTINUE
5720.  RMS2(1)=RHS(1)
5740.  IF(.IFUNC.EQ.0)GO TO 415
5760.  DO 410 J=1,NFUNC
5780.  C2(1,IFUNCS(J))=0
5800.  RMS2(1)=RHS2(1)-C(1,IFUNCS(J))*X(IFUNCS(J))
5820.  410 CONTINUE
5840.  415 CONTINUE
5860.  IF(M3ARG.LE.0)GO TO 420
5880.  IF(NIMUS.EQ.0)GO TO 417
5900.  IF(M3.EQ.0)GO TO 417
5920.  DO 416 I=1,M3
5940.  M1=NONM(I)
5960.  RMS2(M1+1)=0
5980.  DO 416 J=1,N
6000.  C2(M1+1,J)=0
6020.  416 CONTINUE
6040.  417 CONTINUE
6060.  C2(1,N4)=1
6080.  RMS2(1)=RHS2(1)
6100.  DO 418 I=1,M2ARG
6120.  DO 418 J=MP1,MPM
6140.  C2(I,J)=0
6160.  418 CONTINUE
6180.  DO 419 I=1,M
6200.  C2(1,I)=C2(1,I)
6220.  419 CONTINUE
6240.  420 CONTINUE
6260.  WRITE(1,*)NARG,M2ARG,ARG
6280.  WRITE(1,*)(OBJ2(J),J=1,NARG)
6300.  WRITE(1,*)(RHS2(1),I=1,M2ARG)
6320.  DO 422 I=1,M2ARG
6340.  WRITE(1,*)(C2(I,J),J=1,NARG)
6360.  422 CONTINUE
6380.  RE*IND 1
6400.  CALL SUBLP(X2,OPT)
6420.  RE*IND 1
6440.  DO 427 J=1,N
6460.  IF(.IFUNC.EQ.0)GO TO 426
6480.  DO 425 I=1,NFUNC

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6500. IF (IFUNC(1).EQ.J) GO TO 427
6520. 425 CONTINUE
6540. 426 CONTINUE
6560. X(J)=X2(J)
6580. 427 CONTINUE
6600. *ABOVE THE ARGUMENTS FOR LINEAR PROGRAMMING ARE PREPARED.
6620. DO 450 J=1,N
6640. DELX(J)=X(J)-XRAR(J)
6660. 450 CONTINUE
6680. GO TO 600
6700. *WORKLOAD OPTION FOLLOWS:
6720. 500 CONTINUE
6740. WRITE(6,9275)
6760. 9275 FORMAT(/1X,'ENTER CHANGE IN MISSION POPULATION (OR ZERO TO RETAIN CURRENT VALUE):')
6780. READ(5,*)XVAL
6800. NAKG=N
6820. M2ARG=M2
6840. M3ARG=M3
6860. *RITE(6,9280)
6880. 9280 FORMAT(/1X,'ENTER THE NUMBER OF WORKLOAD INDICATORS FOR WHICH CHANGES WILL BE SPECIFIED:')
6900. 510 CONTINUE
6920. READ(5,*)NINDS
6940. IF (NINDS.GT.0.AND.NINDS.LE.N2) GO TO 520
6960. IF (NINDS.EQ.0) GO TO 575
6980. *RITE(6,9160)N2
7000. GO TO 510
7020. 520 CONTINUE
7040. WRITE(6,9290)
7060. 9290 FORMAT(/1X,'ENTER WORKLOAD INDICATOR AND ASSOCIATED PERCENT CHANGES (ONE INDICATOR/%
7080. 1X,'PER LINE) USING THE FOLLOWING NUMBERS TO DENOTE WORKLOAD INDICATORS:')
7100. DO 530 J=1,N2
7120. *RITE(6,9200)J,(MP(J,K),K=1,8)
7140. 530 CONTINUE
7160. WRITE(6,9210)
7180. DO 560 J=1,NINDS
7200. *RITE(6,9300)
7220. 9300 FORMAT(1X,'WORKLOAD INDICATOR:CHANGE:')
7240. 540 CONTINUE
7260. READ(5,*)IND*,PRCNT
7280. IF (IND*.GT.0.AND.IND*.LE.N2) GO TO 550
7300. *RITE(6,9310)
7320. 9310 FORMAT(/1X,'INVALID WORKLOAD INDICATOR--RE-ENTER WORKLOAD INDICATOR AND CHANGE:')
7340. GO TO 540
7360. 550 CONTINUE
7380. DELX(MPIND(IND*))=PRCNT*XRAR(MPIND(IND*))/100
7400. *THE ACTUAL WORKLOAD INDICATOR WHICH THE USER SPECIFIES IS CHANGED.
7420. 560 CONTINUE
7440. N2ARG=N2+M3
7460. DO 565 J=1,N2
7480. IFUNC(J)=MPIND(J)
7500. X(MPIND(J))=XRAR(MPIND(J))+DELX(MPIND(J))
7520. 565 CONTINUE
7540. M2ARG=M4
7560. IF (M3.EQ.0) GO TO 575

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7580. NO 570 J=1,M3
7600. MI=NOMIT(J)
7620. IF U*CS(J+N2)=MI
7640. X(MI)=RHS(MI+1)/C(MI+1,MI)
7660. DO 570 I=N,N
7680. X(MI)=X(MI)-C(MI+1,I)*X(I)/C(MI+1,MI)
7700. 570 CONTINUE
7720. 575 CONTINUE
7740. RHS(I)=RHS(I)-XRAR(N4)-XVAL
7760. NO 580 J=1,M
7780. 06-J2(J)=1
7800. 580 CONTINUE
7820. NO 590 J=MP1,MPM
7840. 06J2(J)=0
7860. 590 CONTINUE
7880. GO TO 412
7900. 600 CONTINUE
7920. *RITF(6,9320)
7940. 9320 FORMAT(/1X,'ENTER PRINT OPTION AS FOLLOWS:',//%
7960. 4X,'1=DISPLAY MILITARY/CIVILIAN BREAKOUT',//%
7980. 4X,'2=DISPLAY TOTAL MANPOWER ONLY',//%
8000. 1X,'PRINT OPTION IS:')
8020. 610 CONTINUE
8040. READ(5,*)IOPT
8060. IF (IOPT.GT.0.AND.IOPT.LT.3)GO TO 620
8080. IF (IOPT.EQ.199)STOP
8100. *WRITE(6,9090)
8120. GO TO 610
8140. 620 CONTINUE
8160. *THE TOTAL FUNCTIONAL MANPOWER PRINTOUT WILL NOW BE MADE.
8180. DO 630 K=1,3
8200. XTOT(K)=0
8220. 630 CONTINUE
8240. *WRITE(6,9330)
8260. 9330 FORMAT(////)
8280. *RITE(b,9340)(CNAM(K),K=1,8)
8300. 9340 FORMAT(31X,8A5//)
8320. *RITF(b,9350)
8340. 9350 FORMAT(/29X,'FUNCTIONAL MANPOWER (TOTAL)')
8360. *RITF(b,9360)
8380. 9360 FORMAT(1X,'FUNCTION',36X,'FY78',6X,'CHANGE',1X,'RESULTANT',1X,'PERCENT',%
8400. 43X,'MANPOWER',11X,'MANPOWER',2X,'CHANGE'//)
8420. NO 650 I=1,M
8440. APCNT(I)=0
8460. IF (XRAR(I).NE.0) XPCNT(I)=DELX(I)/XRAR(I)*100.
8480. XPR(I,1)=XBAS(I)*XBASES
8500. XPR(I,2)=DELX(I)*XBASES
8520. XPR(I,3)=XPR(I,1)+XPR(I,2)
8540. DO 640 K=1,3
8560. XTOT(K)=XTOT(K)+XPR(I,K)
8580. 640 CONTINUE
8600. *WRITE(6,9370)(FNAM(I,K),K=1,8),(XPR(I,K),K=1,3),XPCNT(I)
8620. 9370 FORMAT(1X,8A5,1X,F9.1,1X,F9.1,1X,F9.1,2X,F7.2)
8640. 650 CONTINUE

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8080.      PCNT=0
8081.      IF(XTOT(1).NE.0)PCNT=XTOT(2)/XTOT(1)*100
8082.      WRITE(6,9380)(XTOT(K),K=1,3),PCNT
8083.      9380 FORMAT(6X,'TOTAL',31X,F9.1,1X,F8.1,1X,F9.1,2X,F7.2)
8084.      IF(TOPT.FQ.2)GO TO 715
8085.      *THE MILITARY FUNCTIONAL MANPOWER PRINTOUT WILL NOW BE MADE.
8086.      DO 660 K=1,3
8087.      XTOT(K)=0
8088.      660 CONTINUE
8089.      *WRITE(6,9330)
8090.      WRITE(6,9330)
8091.      9330 FORMAT(27X,'FUNCTIONAL MANPOWER (MILITARY)')
8092.      *WRITE(6,9360)
8093.      DO 680 I=1,M
8094.      XPCNT(I)=PCNTMIL(I)*PCNT(1)/100.
8095.      DO 670 K=1,3
8096.      XNIL(I,K)=PCIMIL(I)*XPR(I,K)/100.
8097.      XTOT(K)=XTOT(K)+XNIL(I,K)
8098.      670 CONTINUE
8099.      *WRITE(6,9370)(FNAM(I,K),K=1,8),(XNIL(I,K),K=1,3),XPCNT(I)
8100.      WRITE(6,9370)
8101.      680 CONTINUE
8102.      PCNT=0
8103.      IF(XTOT(1).NE.0)PCNT=XTOT(2)/XTOT(1)*100.
8104.      *RITE(6,9380)(XTOT(K),K=1,3),PCNT
8105.      9380 FORMAT(6X,'TOTAL',31X,F9.1,1X,F8.1,1X,F9.1,2X,F7.2)
8106.      *THE CIVILIAN FUNCTIONAL MANPOWER PRINTOUT WILL NOW BE MADE.
8107.      DO 690 K=1,3
8108.      XTOT(K)=0
8109.      690 CONTINUE
8110.      *WRITE(6,9330)
8111.      WRITE(6,9330)
8112.      9330 FORMAT(27X,'FUNCTIONAL MANPOWER (CIVILIAN)')
8113.      DO 710 I=1,M
8114.      XPCNT(I)=XPCNT(I)
8115.      DO 700 K=1,3
8116.      XPR(I,K)=XPR(I,K)-XNIL(I,K)
8117.      XTOT(K)=XTOT(K)+XPR(I,K)
8118.      700 CONTINUE
8119.      *WRITE(6,9370)(FNAM(I,K),K=1,8),(XPR(I,K),K=1,3),PCNT
8120.      WRITE(6,9370)
8121.      710 CONTINUE
8122.      PCNT=0
8123.      IF(XTOT(1).NE.0)PCNT=XTOT(2)/XTOT(1)*100.
8124.      *RITE(6,9380)(XTOT(K),K=1,3),PCNT
8125.      9380 FORMAT(6X,'TOTAL',31X,F9.1,1X,F8.1,1X,F9.1,2X,F7.2)
8126.      *SLACK VARIABLES WILL NOW BE PRINTED.
8127.      *RITE(6,9330)
8128.      DO 720 I=1,M
8129.      *RITE(6,9405)
8130.      9405 FORMAT(30X,'MANPOWER SLACK VARIABLES')
8131.      *RITE(6,9406)
8132.      9406 FORMAT(11X,'FUNCTION',40X,'SLACK')
8133.      DO 717 I=1,M
8134.      *RITE(6,9407)(FNAM(I,K),K=1,8),X2(I,M)
8135.      9407 FORMAT(11X,'DAS',3X,F10.2)
8136.      717 CONTINUE

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9740. THE WORKLOAD INDICATOR PRINTOUT WILL NOW BE MADE.
9750. *RITE(0,9330)
9760. *RITE(0,9410)
9800. 9410 FORMAT(34X,'OUTPUT/WORKLOAD'//)
9820. *RITE(6,9420)
9840. 9420 FORMAT(1X,'WORKLOAD INDICATOR',25X,'FY78',7X,'CHANGE',1X,'RESULTANT',2X,'PERCENT'//%
9860. 42X,'INDICATOR',11X,'INDICATOR',2X,'CHANGE'//)
9880. DO 740 I=1,N3
9900. XPR1=CO*ST(I)
9920. XPR2=0
9940. IF (ANS(I).GT.0) GO TO 720
9960. WRITE(6,9070) (NAMS(I,K),K=1,8)
9980. GO TO 740
10000. 720 CONTINUE
10020. DO 730 J=1,N
10040. XPR1=XPR1+XBASES*WIND(I,J)*XBAR(J)
10060. XPR2=XPR2+XBASES*WIND(I,J)*DELX(J)
10080. 730 CONTINUE
10100. XPR3=XPR1+XPR2
10120. PCNT=0
10140. IF (XPR1.NE.0) PCNT=XPR2/XPR1*100.
10160. *RITE(6,9430) (NAMS(I,K),K=1,8),XPR1,XPR2,XPR3,PCNT
10180. 9430 FORMAT(1X,8A5,1X,F10.1,1X,F9.1,1X,F10.1,1X,F6.1)
10200. 740 CONTINUE
10220. IF (BASES.EQ.0) GO TO 750
10240. ISUM=CSUM*BASES
10260. IR=BASES
10280. *RITE(6,9440) IR,ISUM
10300. 9440 FORMAT(///1X,'THE CHANGE ACHIEVED BY OPENING ',I3,' BASE(S) IS ',I6)
10320. 750 CONTINUE
10340. IF (ICNT.EQ.CMDS) GO TO 760
10360. *RITE(6,9010) (DASH,K=1,16)
10380. 760 CONTINUE
10400. LOOP=2
10420. IF (CMDS.GT.1) GO TO 10
10440. *RITE(6,9450)
10460. 9450 FORMAT(///1X,'ENTER ITERATION OPTION AS FOLLOWS'//%
10480. 3X,'1=ACCUMULATE CHANGES,2=BEGIN NEW CYCLE,3=STOP'//%
10500. 3X,'ITERATION OPTION=')
10520. 770 CONTINUE
10540. READ(5,*)LOOP
10560. GO TO (10,10,780),LOOP
10580. *WRITE(6,9040)
10600. GO TO 770
10620. 780 CONTINUE
10640. STOP 'RUN COMPLETE'
10660. END

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BOSTST

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20. DIMENSION DELX(50),ICMDS(3)
40. XVAL=0
60. XBASES=1
80. IOPT=0
100. NINDS=0
120. WRITE(6,1000)
140. 10 CONTINUE
160. 1000 FORMAT(/1X,'ENTER COMMAND (1=ATC, 2=SAC, 3=TAC):')
180. READ(5,*)ICMDS(1)
200. IF(ICMDS(1).GE.1.AND.ICMDS(1).LE.3)GO TO 20
220. WRITE(6,1010)
240. 1010 FORMAT(/1X,'INVALID')
260. GO TO 10
280. 20 CONTINUE
300. CALL BOSSUB(XVAL,DELX,NINDS,ICMDS(1),XBASES,IOPT)
320. WRITE(6,1020)XVAL
340. 1020 FORMAT(///1X,'TOTAL MISSION POPULATION CHANGE: ',F11.1)
360. WRITE(6,1030)NINDS,IOPT
380. 1030 FORMAT(/1X,'NO. WORK INDICATORS ALTERED: ',I2,8X,'PRINT OPTION: ',I1//)
400. WRITE(6,1040)
420. 1040 FORMAT(1X,'INDICATOR',6X,'CHANGE'//)
440. DO 30 M=1,50
460. IF(DELX(M).EQ.0)GO TO 30
480. WRITE(6,1050)M,DELX(M)
500. 1050 FORMAT(4X,I2,8X,F10.1)
520. 30 CONTINUE
540. STOP 'RUN COMPLETED'
560. END

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LPSUB

CALL SUBLP(X,OPT)
DIMENSION X(75)
STOP
END

100.
200.
300.
400.

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159.1
159.2
159.3
159.4
159.5
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MATGEN

SURROUTINE MATGEN
COMMON/INFO/A(25,50),B(25,25),IBAS(25),M,M1,M2,N,N1,EPS
DATA NREAD/1,NPRINT/3/
C READ THE NUMBER OF VARIABLES,NUMBER OF CONSTRAINTS AND THE ACCURACY
READ(NREAD,*) N,M,EPS
M1=M+1
M2=M+2
N1=N+1
C READ COST COEFFICIENTS
READ(NREAD,*)(A(2,J),J=2,N1)
C READ RHS
READ(NREAD,*)(A(I,1),I=3,M2)
C INITIALIZE REMAINDER OF INPUT MATRIX
A(2,1)=0.0
DO 200 I=3,M2
READ(NREAD,*)(A(I,J),J=2,N1)
IF(A(I,1).GE.0)GO TO 1050
DO 1000 J=1,N1
A(I,J)=-A(I,J)
1000 CONTINUE
1050 CONTINUE
200 CONTINUE
C END SPECIALIZED INITIALIZATION
C INITIALIZE FIRST ROW
DO 1200 J=1,N1
C=0.0
DO 1100 I=3,M2
1100 C=C+A(I,J)
1200 A(1,J)=-C
RETURN
END

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MISSUB

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10. SUBROUTINE MISSUB(XVAL,DFLX,NINDS,ICMD,XHASES,IOP1)
20. DOUBLE PRECISION FILES,OREVY,FILE,TITLS,PEC,CNAME,TROROP
30. DOUBLE PRECISION TITLES,HEADS,TIT2,TITL1,TITL2
40. DIMENSION FILES(16),CNAME(8),TROROP(8),TITLS(90,8),PEC(50),TITL2(3)
50. DIMENSION HEADS(2,6),TITLES(4,4),TITL1(5,3),OREVY(4)
60. DIMENSION XMS(150),CXMS(150),DFLX(50)
70. DIMENSION NSUBL(60),NCOL(60),NSURR(60,30),COEFF(60,30)
80. DIMENSION NSUBL2(20),NCOL2(20),NSURR2(20,30),COEFF2(20,30)
90. DIMENSION IE(6),ME(6),TIT(6)
100. DATA FILES/PATCTR,SACIR,TACTR,ATCOP,SACOP,ATACOP/
110. DATA TITL2/'M/O/S',,/,
120. DATA HEADS/'AIRCR',AFT,FLY H,RS, SORTI,ES,
130. 'MISS',LES,QUANT,ITY,MISSN,MP,
140. DATA TITLES/'AIRCR',AFT I,INVENT,ORY:FLYIN,G HOU,RS:
150. 'SORTI',FS:,,,'MISSI,LF IN,VENTO,RY:
160. DATA TITL1/'AI,RCRAF,T CAP,ABILI,TY
170. 'MISSILE',CAPA,BILIT,Y
180. 'OTHER',MISS,ION C,APARI,LITY
190. 10 CONTINUE
200. WRITE(6,1000)
210. 1000 FORMAT(1X,'ENTER MISSION TYPE (1=TYPICAL, 2=OPERATIONAL):')
220. 20 CONTINUE
230. READ(3,*)INTYPE
240. IF (INTYPE.EQ.1.OR.INTYPE.EQ.2)GO TO 30
250. WRITE(6,1010)
260. 1010 FORMAT(1X,'INVALID--ENTER 1 OR 2:')
270. GO TO 20
280. 30 CONTINUE
290. SUL=(INTYPE-1)*3+ICMD
300. FILE=FILES(NSUB)
310. EACONE(OFYV,1020)FILE
320. CALL OBEY(OBEYV,4)
330. 1020 FORMAT(10H'EQUATE 2',A5)
340. DO 40 K=1,150
350. CAMIS(K)=0
360. 40 CONTINUE
370. DO 45 K=1,5
380. IC(K)=0
390. 45 CONTINUE
400. READ(2,1030)CNAME(K),K=1,8
410. READ(2,1030)TROROP(K),K=1,8)
420. 1030 FORMAT(1X,A5)
430. READ(2,*)NMISMP
440. IF (NMISMP.EQ.0)GO TO 55
450. DO 50 K=1,NMISMP
460. READ(2,1040)ANIS(M),PEC(M),(TITLS(M,K),K=1,8)
470. 1040 FORMAT(1X,F10.1,X,A5,1X,A5)
480. 50 CONTINUE
490. 55 CONTINUE
500. READ(2,*)NOTIM
510. IF (NOTIM.EQ.0)GO TO 65
520. IF (5)=NMISMP+1
530. DO 60 K=1,NOTIM
540. READ(2,1040)ANIS(M+NMISMP),PEC(M+NMISMP),(TITLS(M+NMISMP,K),K=1,8)

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550.      GO CONTINUE
560.
570.      READ(2,*)NOTHW
580.      ME(5)=NMISMP+NOTHW
590.      IF(NOTHW.EQ.0)GO TO 75
600.      IE(5)=NMISMP+1
610.      DO 70 M=1,NOTHW
620.      READ(2,1050)XMIS(M+ME(5)),(TITLS(M+ME(5),K),K=1,8)
630.      1050 FORMAT(1X,F10.1,1X,8A5)
640.      70 CONTINUE
650.      75 CONTINUE
660.      READ(2,*)NMISL
670.      ME(5)=ME(5)+NOTHW
680.      ME(4)=ME(5)+NMISL
690.      IF(NMISL.EQ.0)GO TO 85
700.      IE(4)=ME(5)+1
710.      DO 80 M=1,NMISL
720.      READ(2,1050)XMIS(M+ME(5)),(TITLS(M+ME(5),K),K=1,8)
730.      80 CONTINUE
740.      85 CONTINUE
750.      READ(2,*)NACRFT
760.      ME(1)=ME(4)+NACRFT
770.      ME(2)=ME(1)+NACRFT
780.      ME(3)=ME(2)+NACRFT
790.      IF(NACRFT.EQ.0)GO TO 95
800.      IE(1)=ME(4)+1
810.      IE(2)=ME(1)+1
820.      IE(3)=ME(2)+1
830.      DO 90 M=1,NACRFT
840.      READ(2,1060)XMIS(ME(4)+M),XMIS(ME(1)+M),XMIS(ME(2)+M), (TITLS(ME(4)+M,K),K=1,8)
850.      1060 FORMAT(1X,F10.1,1X,F10.1,1X,F10.1,1X,F10.1,1X,8A5)
860.      90 CONTINUE
870.      95 CONTINUE
880.      READ(2,*)NEQU1
890.      IF(NEQU1.EQ.0)GO TO 105
900.      DO 100 M=1,NEQU1
910.      READ(2,*)NSURL(M),NCOL(M)
920.      NCOLS=NCOL(M)
930.      READ(2,*)NSURR(M,N),COEFF(M,N),N=1,NCOLS)
940.      100 CONTINUE
950.      105 CONTINUE
960.      IF(NSURL(NEQU1).NE.NMISMP)GO TO 115
970.      XMIS(NMISMP)=0
980.      NCOLS=NCOL(NEQU1)
990.      DO 110 M=1,NCOLS
1000.      XMIS(NMISMP)=XMIS(NMISMP)+COEFF(NEQU1,M)*XMIS(NSURR(NEQU1,M))
1010.      110 CONTINUE
1020.      115 CONTINUE
1030.      READ(2,*)NEQU2
1040.      IF(NEQU2.EQ.0)GO TO 119
1050.      DO 117 M=1,NEQU2
1060.      READ(2,*)NSURL2(M),NCOL2(M)
1070.      NCOLS=NCOL2(M)
1080.      READ(2,*)NSURR2(M,N),COEFF2(M,N),N=1,NCOLS)

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1090.
1100.
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1120.
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1590.
1600.
1610.

117 CONTINUE
119 CONTINUE
*FINISHED INPUT, BEGIN PROMPTING
IF((NACFT.EQ.0) GO TO 150
*RITE(6,1070)
1070 FORMAT(/1X,'AIRCRAFT M/D/S TYPES:')
DO 120 M=1,NACFT
*RITE(6,1080)M,(TTILS(ME(4)*M,K),K=1,8)
1080 FORMAT(3X,12,'=',8A5)
120 CONTINUE
*RITE(6,1090)
1090 FORMAT(/1X,'ENTER THE NUMBER OF AIRCRAFT/FLYING HOUR CHANGES TO BE MADE:')
READ(5,'')NCHG
IF(NCHG.EQ.0) GO TO 150
*RITE(6,1100)
*RITE(6,1110)
*RITE(6,1120)
1100 FORMAT(/1X,'ENTER AIRCRAFT M/D/S TYPE, CHANGE IN NUMBER OF AIRCRAFT:')
1110 FORMAT(3X,'AND CHANGE IN NUMBER OF FLYING HOURS')
1120 FORMAT(1X,'ON EACH LINE, ENTER CHANGES FOR ONE M/D/S TYPE:')
DO 140 N=1,NCHG
125 CONTINUE
READ(5,'')ITEM,VALUE1,VALUE2
VALUE2=VALUE2*VALUE1
IF(ITEM.GT.0.AND.ITEM.LE.NACFT) GO TO 130
*RITE(6,1130)NACFT
1130 FORMAT(1X,'INVALID--ENTER 1 TO ,12,:')
GO TO 125
130 CONTINUE
CXMIS(ME(4)+ITEM)=VALUE1
CAPIS(ME(1)+ITEM)=VALUE2
140 CONTINUE
150 CONTINUE
IF(NMISSL.EQ.0) GO TO 190
*RITE(6,1140)
1140 FORMAT(/1X,'MISSILE TYPES:')
DO 160 M=1,NMISSL
*RITE(6,1060)M,(TTILS(ME(5)*M,K),K=1,8)
160 CONTINUE
*RITE(6,1150)
1150 FORMAT(/1X,'ENTER THE NUMBER OF MISSILE CHANGES TO BE MADE:')
READ(5,'')NCHG
IF(NCHG.EQ.0) GO TO 190
*RITE(6,1160)
*RITE(6,1120)
1160 FORMAT(/1X,'ENTER MISSILE TYPE, CHANGE IN NUMBER OF MISSILES')
DO 170 M=1,NCHG
165 CONTINUE
READ(5,'')ITEM,VALUE1
IF(ITEM.GT.0.AND.ITEM.LE.NMISSL) GO TO 170
*RITE(6,1130)NMISSL
GO TO 165
170 CONTINUE
CXMIS(ME(5)+ITEM)=VALUE1

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1620. 180 CONTINUE
1630. 190 CONTINUE
1640. IF(NOTH+NOTH*FU.0)GO TO 230
1650. *RITE(6,1170)
1660. 1170 FORMAT(/IX,'OTHER MISSION CAPABILITY:')
1670. *X=NOTH+NOTH
1680. DO 200 M=1,MX
1690. *RITE(6,1080)*,(TTLS(NMISMP+M,K),K=1,8)
1700. 200 CONTINUE
1710. *RITE(6,1180)
1720. 1180 FORMAT(/IX,'ENTER THE NUMBER OF OTHER MISSION CHNGFS TO BE MADE:')
1730. READ(5,*)NCHG
1740. IF(NCHG.EQ.0)GO TO 230
1750. *RITE(6,1190)
1760. *RITE(6,1200)
1770. 1190 FORMAT(/IX,'ENTER TYPE OF OTHER MISSION CAPABILITY, CHANGE IN QUANTITY')
1780. 1200 FORMAT(/IX,'(ON EACH LINE, ENTER CHANGES FOR ONE TYPE OF OTHER SUPPORTS):')
1790. DO 220 M=1,NCHG
1800. 205 CONTINUE
1810. READ(5,*)ITEM,VALUE1
1820. IF(ITEM.GT.0.AND.ITEM.LE.MX)GO TO 210
1830. *RITE(6,1130)MX
1840. GO TO 205
1850. 210 CONTINUE
1860. CXMIS(NMISMP+ITEM)=VALUE1
1870. 220 CONTINUE
1880. 230 CONTINUE
1890. IF(NEQU1*FU.0)GO TO 260
1900. DO 250 M=1,NEQU1
1910. *COLSENCOL(M)
1920. DO 240 N=1,NCOLS
1930. CXMIS(NSURL(M))=CXMIS(NSURL(M))+COEFF(M,N)*CXMIS(NSURL(M,N))
1940. 240 CONTINUE
1950. 250 CONTINUE
1960. 260 CONTINUE
1970. *H=SEU
1980. IF(NEQU2*FU.0)GO TO 290
1990. DO 280 K=1,NCUGO2
2000. *COLSENCOL2(K)
2010. DO 270 N=1,NCOLS
2020. DELX(NSURL2(M))=DELX(NSURL2(M))+COEFF2(M,N)*CXMIS(NSURL2(M,N))
2030. 270 CONTINUE
2040. IF(DELX(NSURL2(M)).EQ.0)GO TO 280
2050. *H=SENUMPS+1
2060. 280 CONTINUE
2070. 290 CONTINUE
2080. *X=VAL
2090. IF(NMISMP.EQ.0)GO TO 310
2100. DO 300 M=1,NMISMP
2110. *X=VAL+CXMIS(M)
2120. 300 CONTINUE
2130. 310 CONTINUE
2140. *RITE(6,1210)
2150. *RITE(6,1220)

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2160.      *RIIF(6,1230)
2170.      *RIIF(6,1240)
2180.      1210 FORMAT(//1X,ENTER PRINT OPTION AS FOLLOWS: )
2190.      1220 FORMAT(4X,1=DISPLAY MILITARY/CIVIL BREAKOUT, )
2200.      1230 FORMAT(4X,2=DISPLAY TOTAL MANPOWER ONLY, )
2210.      1240 FORMAT(//1X,PRINT OPTION IS: )
2220.      320 CONTINUE
2230.      HEAD(5,*)IOPT
2240.      IF(IOPT.GT.0.AND.IOPT.LT.3)GO TO 330
2250.      IF(IOPT.EQ.199)STOP
2260.      *RIIF(6,1130)2
2270.      GOTO 320
2280.      330 CONTINUE
2290.      *RIIF(6,9330)
2300.      9330 FORMAT(////)
2310.      *RIIE(6,9340) (CNAME(K),K=1,8)
2320.      9340 FORMAT(31X,8A5,////)
2330.      *RIIE(6,9350) (TROPO(K),K=1,8)
2340.      9350 FORMAT(25X,8A5,/)
2350.      J01=0
2360.      ITI(1)=0
2370.      ITI(2)=IACKFT
2380.      ITI(3)=IACR+1*2
2390.      ITI(4)=0
2400.      ITI(5)=0
2410.      J0 390 J=1,5
2420.      IF(J.EQ.2.OR.J.EQ.3)GO TO 340
2430.      J01=J01+1
2440.      IF(IE(J).FQ.0)GO TO 390
2450.      *RIIE(6,9360) (TITLE1(K,J01),K=1,5)
2460.      9360 FORMAT(25X,5A5/)
2470.      ITI2=ITI2(2)
2480.      IF(J.EQ.5)GO TO 350
2490.      340 CONTINUE
2500.      IF(IE(J).FQ.0)GO TO 390
2510.      ITI2=ITI2(1)
2520.      *RIIE(6,9370) (TTILES(K,J),K=1,4)
2530.      9370 FORMAT(1X,4A5/)
2540.      350 CONTINUE
2550.      *RIIF(6,9375) ITI2, (HEADS(K,J),K=1,2), (HEADS(K,J),K=1,2)
2560.      9375 FORMAT(2A,4A5,39X,FY79,6X,CHANGE RESULTANT PERCENT,/,%
2570.      44X,2A5,10X,2A5,CHANGE,/)
2580.      ITI=0
2590.      IT2=0
2600.      IT3=0
2610.      IST=IE(J)
2620.      *ST=ME(J)
2630.      J0 370 *TEST=ST
2640.      ROLDC=AMIS(M)*XBASES
2650.      COLDC=CMIS(M)*XBASES
2660.      RVAL=ROLD+COLD
2670.      PCNT=0
2680.      IF (AMIS(3).EQ.0)GO TO 360
2690.      PCNT=COLD/ROLD*100

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2700. 360 CONTINUE
2710. WRITE(6,9380)(ITLS(M-ITIT(J),K),K=1,8),ROLD,COLD,RVAL,PCNT
2720. 9380 FORMAT(1X,6AS,1X,F10.1,F9.1,F10.1,2X,F7.2)
2730. T1=T1+ROLD
2740. T2=T2+COLD
2750. T3=T3+RVAL
2760. 370 CONTINUE
2770. PCNT=0
2780. IF(T1-EG.0)60 TO 380
2790. PCNT=T2/T1*100
2800. 380 CONTINUE
2810. *WRITE(6,9390)T1,T2,T3,PCNT
2820. 9390 FORMAT(1X,'TOTAL',31X,F10.1,F9.1,F10.1,2X,F7.2//)
2830. 390 CONTINUE
2840. IF(NMISMP-EG.0)60 TO 420
2850. T1=0
2860. T2=0
2870. T3=0
2880. ITT2=ITITL2(3)
2890. *WRITE(6,9400)
2900. 9400 FORMAT(32X,'MISSION MANPOWER',//)
2910. *WRITE(6,9375)ITT2,(HEADS(K,6),K=1,2),(HEADS(K,6),K=1,2)
2920. 30 410 *Z1,NMISMP
2930. ROLD=XMIS(M)*XBASES
2940. COLD=XMIS(M)*XBASES
2950. RVAL=ROLD+COLD
2960. PCNT=0
2970. IF(XMIS(M)-EG.0)60 TO 400
2980. PCNT=COLD/ROLD*100
2990. 400 CONTINUE
3000. *WRITE(6,9380)(ITLS(M,K),K=1,8),ROLD,COLD,RVAL,PCNT
3010. T1=T1+ROLD
3020. T2=T2+COLD
3030. T3=T3+RVAL
3040. 410 CONTINUE
3050. 420 CONTINUE
3060. PCNT=0
3070. IF(T1-EG.0)60 TO 430
3080. PCNT=T2/T1*100
3090. 430 CONTINUE
3100. *WRITE(6,9390)T1,T2,T3,PCNT
3110. *FUTR:
3120. END

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NBOSPG

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20.  INTEGER CMDS,CMU
40.  DOUBLE PRECISION DASH,FNAM,CNAM,FILES,FILE,MP,WNAMS
60.  DIMENSION OHEYV(4),OHEYW(4),OHEYX(4),OHEY(4),MLCVCN(3,2)
80.  DIMENSION TOT(3),CMD(3),FILFS(3)
100. DIMENSION PCTMIL(50,3),XMPCNT(50,3),XPCNT(50),XTOT(3),XPR(50,3),XNIL(50,3,3),WIND(50,50),WHS(50),CONST(50)
120. DIMENSION X(75),XBAR(50),DELX(50),C(50,50),MPIND(50),IFUNCS(50),CSUMY(50),HOMIT(50),ORJ2(50)
140. DIMENSION RHIS(50),ORJ(50),C2(50,50),RHS2(50),X2(75)
160. DIMENSION FUC(50),FNAM(50,8),CNAM(8),MP(50,8),WNAMS(50,8)
180. DATA OHEY4 //EQUATE 2 TOTSL//
200. DATA OHEYX //EQUATE 3 ROSLS//
220. DATA OHEY //EQUATE 1 ROSTMP//
240. DATA FILES //ATCFL//SACFL//TACFL//
260. DATA DASH //*****//
280. DATA MLCVCN(1,1) //OFF//,MLVCN(1,2) //CERS//
286. DATA MLCVCN(2,1) //AIRM//,MLVCN(2,2) //EN 1//
288. DATA MLCVCN(3,1) //CIVI//,MLVCN(3,2) //LIAN//
290. *A MAPPOWER TOTAL FOR EACH COMMAND WILL NOW BE ENTERED FROM TOTSL.
300. CALL OHEY(OHEYX,4)
320. READ(2,*) (TOT(K),K=1,3)
340. READ(2)
360. CALL OHEY(OHEYX,4)
380. CALL OHEY(OHEYX,4)
400. LOOP=2
420. WRITE(6,9000) (DASH,K=1,16)
440. 9000 FORMAT(16A5//20X,'MISSION IMPACT GENERALIZED EXPLANATORY',%
460. 21X,'BASE OPERATING SUPPORT MODEL (GEBOS-M)',)
480. 10 CONTINUE
500. *WRITE(6,9010) (DASH,K=1,16)
520. 9010 FORMAT(//16A5//)
540. IF (LOOP.EQ.1) GO TO 55
560. *LOOP EQUALS 1 WHEN CHANGES ARE ACCUMULATED.
580. *THE COMMAND(S) REMAIN THE SAME.
600. WRITE(6,9020)
620. 9020 FORMAT(//1X,'ENTER COMMANDS (1=ATC,2=SAC,3=TAC):')
640. 20 CONTINUE
660. READ(5,9030) (CMD(K),K=1,3)
680. 9030 FORMAT(//1X,11,1X,11)
700. CMDS=0
720. DO 30 K=1,3
740. IF (CMD(K).EQ.0) GO TO 30
760. IF (CMD(K).LT.1.OR.CMD(K).GT.3) GO TO 35
780. CMDS=CMDS+1
800. 30 CONTINUE
820. IF (CMDS.GT.0) GO TO 40
840. 35 CONTINUE
860. *WRITE(6,9040)
880. 9040 FORMAT(//1X,'INVALID--ENTER 1,2, OR 3:')
900. GO TO 20
920. 40 CONTINUE
940. *A VALID COMMAND HAS BEEN ENTERED.
960. *CMU EQUALS THE NUMBER OF COMMANDS BEING CHANGED.
980. *
1000. *THE TOTAL MAPPOWER IS NOW COMPUTED (ALL COMMANDS).
1020. TOTSL=0

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1040. DO 50 K=1,CMDS
1060. TOT5=TOT5+TOT(CMD(K))
1080. 50 CONTINUE
1100. 55 CONTINUE
1120. *A LOOP IS SET UP TO RUN THROUGH DATA INPUT,CHANGE,AND PRINT
1140. *PROCEDURES FOR EACH COMMAND.
1160. DO 760 ICNT=1,CMDS
1180. *INITIALIZATION OF VARIABLES FOLLOWS.
1200. DO 60 K=1,50
1220. DELX(K)=0
1240. IFUNCS(K)=0
1260. 60 CONTINUE
1280. BASES=0
1300. ICOPT=0
1320. IFUNC=0
1340. IF (LOOP.FQ.2) GO TO 80
1360. DO 70 J=1,N
1380. XBAR(J)=X(J)
1400. 70 CONTINUE
1420. 80 TO 165
1440. 80 CONTINUE
1460. *THE INPUT FILE WILL NOW BE DETERMINED: ATCFL,SACFL, OR TACFL.
1480. FILE=FILES(CMD(ICNT))
1500. ENCODE(ORETV,9050)FILE
1520. CALL OBEY(OHEYV,4)
1540. 9050 FORMAT(10H'EQUATE 2 ,A5)
1560. *THE X# VALUES, COEFFICIENTS, AND FUNCTION AND WORKLOAD INDICATOR TITLES
1580. *WILL NOW BE ENTERED. THE X# VALUES WILL BE COMPUTED FROM THE X# VALUES.
1600. READ(2,*)XBASES,CSUM
1620. READ(2,9070) (CNAM(K),K=1,8)
1640. 9070 FORMAT(1X,8A5)
1660. READ(2,*)M1,M2,ARG,N2,N3,M3,M4
1680. DO 85 J=1,N
1700. READ(2,*)XBAR(J)
1720. 85 CONTINUE
1740. DO 90 I=1,M
1760. READ(2,*)FUNC(I),(PCTMIL(I,J),J=1,3),CSUMY(I)
1780. READ(2,9070) (FNAM(I,K),K=1,8)
1800. 90 CONTINUE
1820. READ(2,*) (OHJ(J),J=1,N)
1840. O-J2(N+1)=1
1860. READ(2,*) (R/IS(I),I=1,M2)
1880. MP1=M+1
1900. MP2=2*M
1920. N4=4*P4+1
1940. DO 95 I=1,M2
1960. READ(2,*) (C(I,J),J=1,N)
1980. C2(I,N+1)=0
2000. 95 CONTINUE
2020. C2(I,N+1)=1
2040. IF (M3.GT.0) READ(2,*) (WOMIT(I),I=1,M3)
2060. DO 140 J=1,N2
2080. READ(2,*) MPIND(J)
2100. READ(2,9070) (MP(J,K),K=1,8)

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2120. 140 CONTINUE
2140. *THE ARRAY MP CONTAINS TITLES FOR CHANGEABLE WORKLOAD INDICATORS.
2160. DO 160 J=1,NJ
2180. READ(2,*)WNS(J)
2200. IF(WNS(J).EQ.0)GO TO 150
2220. READ(2,*)(WIND(J,K),K=1,N),CONST(J)
2240. 150 CONTINUE
2260. READ(2,9070)(WNAMS(J,K),K=1,8)
2280. 160 CONTINUE
2300. *THE ARRAY WNAMS CONTAINS TITLES FOR THE PRINTED WORKLOAD INDICATORS.
2320. *IF WNS(J) EQUALS ZERO, THE TITLE IS A HEADER OR A SKIPPED LINE.
2340. *THE ARRAY WIND INDICATES THE COMBINATION OF THE ACTUAL WORKLOAD INDICATORS
2360. *WHICH THE PRINTED LINE REPRESENTS.
2380. REWIND 2
2400. 165 CONTINUE
2420. SUMY=0
2440. DO 167 I=1,M
2460. SUMY=SUMY+XBAR(I)
2480. 167 CONTINUE
2500. RNS(1)=SUMY
2520. IF(CMDS.EQ.1)TOTS=SUMY
2540. YAMT=0
2560. USAGE=0
2580. IF(CMDS.EQ.1)GO TO 170
2600. *SPECIAL PROVISIONS MUST BE MADE FOR THE CHANGE OF MORE THAN 1 COMMAND:
2620. *FIRST, ONLY AN ABSOLUTE CHANGE MAY BE MADE, TO BE APPORTIONED TO ALL FUNCTIONS;
2640. *SECOND, NO WORKLOAD INDICATORS MAY BE CHANGED DIRECTLY;
2660. *THIRD, NO CHANGE IN THE NUMBER OF BASES MAY BE SPECIFIED;
2680. *FOURTH, NO ACCUMULATION OF CHANGES IS ALLOWED.
2700. IF(ICNT.EQ.1)GO TO 210
2720. *ON THE FIRST ITERATION OF THE ICNT LOOP, THE ABSOLUTE CHANGE WILL BE SPECIFIED.
2740. *ON SUCCESSIVE ITERATIONS, THE SAME CHANGE IS APPLIED;
2760. *A PRINTOUT, BUT NO CHANGE OPTIONS, IS GIVEN.
2780. GO TO 398
2800. 170 CONTINUE
2820. *WRITE(6,9080)
2840. 9080 FORMAT(/1X,'ENTER CHANGE OPTION (1=MANPOWER,2=WORKLOAD,3=MISSION):')
2860. 180 CONTINUE
2880. READ(5,*)IOPTX
2900. GO TO (190,500,500),IOPTX
2920. *WRITE(6,9090)
2940. 9090 FORMAT(/1X,'INVALID--ENTER 1 OR 2:')
2960. GO TO 180
2980. 190 CONTINUE
3000. *WRITE(6,9100)
3020. 9100 FORMAT(/1X,'ENTER TYPE OF CHANGE SPEC. (1=ABSOLUTE,2=PERCENT,3=NO OVERALL CHANGE SPEC.):')
3040. 200 CONTINUE
3060. READ(5,*)ICGPT
3080. GO TO (210,240,260),ICGPT
3100. *WRITE(6,9040)
3120. GO TO 200
3140. 210 CONTINUE
3160. *WRITE(6,9120)
3180. 9120 FORMAT(/1X,'ENTER ABSOLUTE CHANGE:')

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3200. 220 CONTINUE
3220. READ(5,*)ABSCHG
3240. IF(TOTS*ABSCHG.GE.0)GO TO 230
3260. *RITE(6,9130)
3280. 9130 FORMAT(/1X,'INVALID--CAUSES A NEGATIVE RESULTANT MANPOWER! RF=ENTER:')
3300. GO TO 220
3320. 230 CONTINUE
3340. PRCIT=ABSCHG/TOTS
3360. *AFTER A VALID CHANGE IS ENTERED, IT IS CONVERTED TO A PERCENT FOR COMPUTATIONS.
3380. IF(CMDS.GT.1)GO TO 398
3400. GO TO 260
3420. 240 CONTINUE
3440. *RITE(6,9140)
3460. 9140 FORMAT(/1X,'ENTER PERCENT CHANGE:')
3480. 250 CONTINUE
3500. READ(5,*)PRCNT
3520. IF(PRCNT.GE.-100.160 TO 255
3540. *RITE(6,9130)
3560. GO TO 250
3580. 255 CONTINUE
3600. PRCNT=PRCNT/100.
3620. 260 CONTINUE
3640. *RITE(6,9150)
3660. 9150 FORMAT(/1X,'ENTER THE NUMBER OF FUNCTIONS FOR WHICH CHANGES WILL BE SPECIFIED:')
3680. 270 CONTINUE
3700. READ(5,*)NFUNC
3720. IF(NFUNC.GT.0.AND.NFUNC.LE.4)GO TO 280
3740. *WHEN NO FUNCTIONS ARE SPECIFIED, THE CHANGE IS APPORTIONED TO ALL FUNCTIONS.
3760. IF(NFUNC.EQ.0)GO TO 360
3780. *RITE(6,9160)M
3800. 9160 FORMAT(/1X,'INVALID--ENTER FROM 1 TO 12:')
3820. GO TO 270
3840. 280 CONTINUE
3860. *RITE(6,9170)
3880. IF(ICOPT.NE.3)*WRITE(6,9175)
3900. *RITE(6,9176)
3920. 9170 FORMAT(/1X,'ENTER METHOD BY WHICH FUNCTION CHANGES WILL BE SPECIFIED AS FOLLOWS:','%
3940. 4X,'1=ABSOLUTE NUMBER OF PEOPLE','%
3960. 4X,'2=PERCENT OF FUNCTION MANPOWER','%
3980. 4X,'3=PERCENT OF BOS MANPOWER')
4000. 9175 FORMAT( 4X,'4=PERCENT OF TOTAL CHANGE')
4020. 9176 FORMAT(/1X,'METHOD:')
4040. 290 READ(5,*)METH
4060. IF(ICOPT.EQ.3)GO TO 295
4080. IF(METH.GT.0.AND.METH.LT.5)GO TO 300
4100. *RITE(6,9180)
4120. 9180 FORMAT(/1X,'INVALID--ENTER 1,2,3, OR 4:')
4140. GO TO 290
4160. 295 CONTINUE
4180. IF(METH.GT.0.AND.METH.LT.4)GO TO 300
4200. *RITE(6,9040)
4220. GO TO 290
4240. 300 CONTINUE
4260. *RITE(6,9190)

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4280. 9190 FORMAT(/IX,'ENTER FUNCTIONS AND ASSOCIATED CHANGES (ONE FUNCTION PER LINE),/%
4300. 1X,'USING THE FOLLOWING NUMBERS TO DENOTE FUNCTIONS:'))
4320. DO 310 I=1,M
4340. WRITE(6,9200)I,(FNAM(I,K),K=1,8)
4360. 9200 FORMAT(3X,I2,'=',8A5)
4380. 310 CONTINUE
4400. WRITE(6,9210)
4420. 9210 FORMAT(/)
4440. DO 350 I=1,NFUNC
4460. WRITE(6,9220)
4480. 9220 FORMAT(1X,'FUNCTION,CHANGE:'))
4500. 320 CONTINUE
4520. READ(5,*)IFUNCS(I),AMOUNT
4540. IF(IFUNCS(I).GT.0.AND.(IFUNCS(I).LE.M)GO TO 330
4560. *WRITE(6,9230)
4580. 9230 FORMAT(/1X,'INVALID FUNCTION--RE-ENTER FUNCTION AND CHANGE:'))
4600. GO TO 320
4620. 330 CONTINUE
4640. IF(METH.EQ.1)DELY=AMOUNT
4660. IF(METH.EQ.2)DELY=AMOUNT*XBAR(IFUNCS(I))/100.
4680. IF(METH.EQ.3)DELY=AMOUNT*SUMP/100.
4700. IF(METH.EQ.4)DELY=AMOUNT*PRCNT*SUMP/100.
4720. *CHANGE IN MY IS COMPUTED USING METHOD OF CHANGE CHOSEN PREVIOUSLY.
4740. IF(DELY*XBAR(IFUNCS(I)).GE.0)GO TO 340
4760. WRITE(6,9240)
4780. 9240 FORMAT(/1X,'INVALID CHANGE--NEGATIVE RESULTANT MANPOWER! RE-ENTER FUNCTION AND CHANGE:'))
4800. GO TO 320
4820. 340 CONTINUE
4840. USAGE=USAGE+DELY
4860. YAMT=YAMT+XBAR(IFUNCS(I))
4880. X(IFUNCS(I))=XBAR(IFUNCS(I))+DELY
4900. 350 CONTINUE
4920. 360 CONTINUE
4940. WRITE(6,9250)
4960. 9250 FORMAT(/1X,'IS THERE A CHANGE IN THE NUMBER OF BASES (1=YES,2=NO)?')
4980. 370 CONTINUE
5000. READ(5,*)IOPT
5020. GO TO (340,398),IOPT
5040. *WRITE(6,9090)
5060. GO TO 370
5080. 380 CONTINUE
5100. WRITE(6,9270)
5120. 9270 FORMAT(1X,'ENTER NUMBER OF BASES TO BE OPENED(+) OR CLOSED(-):')
5140. READ(5,*)IBASES
5160. I/O 390 I=2,MPI
5180. IF(I,I-1).NE.0) RHS(I)=RHS(I)+BASES*CSUMP(I-1)/C(I,I-1)
5200. 390 CONTINUE
5220. 398 CONTINUE
5240. *ARG=U
5260. *ARG=H2
5280. NARG=N
5300. IF(ICOPT.NE.3)GO TO 399
5320. NARG=N+1
5340. IF(YAMT.EQ.0)GO TO 400

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5360. IF(USAGE/YAMT.GT.0)RHS(1)=RHS(1)+2*USAGF/YAMT*RHS(1)
5380. GO TO 400
5400. 399 CONTINUE
5420. RHS(1)=RHS(1)+PRCNT*SUMY
5440. 400 CONTINUE
5460. DO 401 J=1,N
5480. ORJ2(J)=ORJ(J)
5500. 401 CONTINUE
5520. IF(MFUNC.EQ.0)GO TO 404
5540. 402 CONTINUE
5560. DO 403 J=1,MFUNC
5580. ORJ2(IFUNCS(J))=0
5600. 403 CONTINUE
5620. 404 CONTINUE
5640. DO 415 I=1,MZARG
5660. DO 405 J=1,N
5680. C2(I,J)=C(I,J)
5700. 405 CONTINUE
5720. RHS2(1)=RHS(1)
5740. IF(MFUNC.EQ.0)GO TO 415
5760. DO 410 J=1,MFUNC
5780. C2(1,IFUNCS(J))=0
5800. RHS2(1)=RHS2(1)-C(1,IFUNCS(J))*X(IFUNCS(J))
5820. 410 CONTINUE
5840. 415 CONTINUE
5860. IF(M3ARG.LE.0)GO TO 420
5880. IF(MINDS.EQ.0)GO TO 417
5900. IF(M3.EQ.0)GO TO 417
5920. DO 416 I=1,M3
5940. M1=MOM1(I)
5960. RHS2(M1+1)=0
5980. DO 416 J=1,N
6000. C2(M1+1,J)=0
6020. 416 CONTINUE
6040. 417 CONTINUE
6060. C2(1,N4)=1
6080. RHS2(1)=RHS2(1)
6100. DO 418 I=1,M2ARG
6120. DO 418 J=MP1,MPM
6140. C2(1,J)=0
6160. 418 CONTINUE
6180. DO 419 I=1,N
6200. C2(1,I)=C2(1,I)
6220. 419 CONTINUE
6240. 420 CONTINUE
6260. WRITE(1,*)NARG,M2ARG,ARG
6280. WRITE(1,*)(ORJ2(J),J=1,NARG)
6300. WRITE(1,*)(RHS2(1),I=1,M2ARG)
6320. DO 422 I=1,M2ARG
6340. WRITE(1,*)(C2(1,J),J=1,NARG)
6360. 422 CONTINUE
6380. REBIND 1
6400. CALL SUHLP(X2,OPT)
6420. RE*IND 1

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6440. DO 427 J=1,N
6460. IF(1/FUNC.EQ.0)GO TO 426
6480. DO 425 I=1,NFUNC
6500. IF(1/FUNC(I).EQ.0)GO TO 427
6520. 425 CONTINUE
6540. 426 CONTINUE
6560. X(J)=X2(J)
6580. 427 CONTINUE
6600. *ABOVE, THE ARGUMENTS FOR LINEAR PROGRAMMING ARE PREPARED.
6620. DO 450 J=1,N
6640. DELX(J)=X(J)-XRAR(J)
6660. 450 CONTINUE
6680. GO TO 600
6700. *WORKLOAD OPTION FOLLOWS:
6720. 500 CONTINUE
6730. IF(1/OPTX.FG.3)GO TO 505
6740. *WRITE(6,9275)
6760. 9275 FORMAT(1X,'ENTER CHANGE IN MISSION POPULATION (OR ZERO TO RETAIN CURRENT VALUE):')
6780. READ(5,*)XVAL
6790. 505 CONTINUE
6800. NARGEN
6820. M2AR=M2
6840. M3ARG=M3
6850. IF(1/OPTX.FG.3)GO TO 562
6860. *WRITE(6,9280)
6880. 9280 FORMAT(1X,'ENTER THE NUMBER OF WORKLOAD INDICATORS FOR WHICH CHANGES WILL BE SPECIFIED:')
6900. 510 CONTINUE
6920. READ(5,*)NINDS
6940. IF(NINDS.GT.0.AND.NINDS.LE.N2)GO TO 520
6960. IF(NINDS.EQ.0)GO TO 575
6980. *WRITE(6,9160)N2
7000. GO TO 510
7020. 520 CONTINUE
7040. *WRITE(6,9290)
7060. 9290 FORMAT(1X,'ENTER WORKLOAD INDICATOR AND ASSOCIATED PERCENT CHANGES (ONE INDICATOR/*
7080. 1X,PER LINE) USING THE FOLLOWING NUMBERS TO DENOTE WORKLOAD INDICATORS:')
7100. DO 530 J=1,N2
7120. *WRITE(6,9200)J,(MP(J,K),K=1,8)
7140. 530 CONTINUE
7160. *WRITE(6,9210)
7180. DO 560 J=1,NINDS
7200. *WRITE(6,9300)
7220. 9300 FORMAT(1X,'WORKLOAD INDICATOR,CHANGE:')
7240. 540 CONTINUE
7260. READ(5,*)INDW,PRCNT
7280. IF(INDW.GT.0.AND.INDW.LE.N2)GO TO 550
7300. *WRITE(6,9310)
7320. 9310 FORMAT(1X,'INVALID WORKLOAD INDICATOR--RE-ENTER WORKLOAD INDICATOR AND CHANGE:')
7340. GO TO 540
7360. 550 CONTINUE
7380. DELX(MPIND(INDW))=PRCNT*XRAR(MPIND(INDW))/100
7400. *THE ACTUAL WORKLOAD INDICATOR WHICH THE USER SPECIFIES IS CHANGED.
7420. 560 CONTINUE
7430. 562 CONTINUE

```

```

7431. IF(10PTX.EQ.3)CALL BOSSUR(XVAL,DELX,NINDS,CMD(1),XBASES,IOPT)
7440. NFUNC=N2*M3
7450. DO 565 J=1,N2
7460. IFUNCS(J)=MPIND(J)
7480. X(MPIND(J))=XBAR(MPIND(J))*DELX(MPIND(J))
7500.
7520. 565 CONTINUE
7540. M2ARG=M4
7560. IF(M3.EQ.0)GO TO 575
7580. DO 570 J=1,M3
7600. MI=MOMIT(J)
7620. IFUNCS(J+N2)=MI
7640. X(MI)=RHS(MI+1)/C(MI+1,MI)
7660. DO 570 I=N4,N
7680. X(MI)=X(MI)-C(MI+1,I)*X(I)/C(MI+1,MI)
7700. 570 CONTINUE
7720. 575 CONTINUE
7740. RHS(1)=RHS(1)-XBAR(N4)-XVAL
7760. DO 580 J=1,M
7780. OBJ2(J)=1
7800. 580 CONTINUE
7820. DO 590 J=MP1,MPH
7840. OBJ2(J)=0
7860. 590 CONTINUE
7880. GO TO 402
7900. 600 CONTINUE
7910. IF(10PTX.EQ.3)GO TO 620
7920. WRITE(6,9320)
7940. 9320 FORMAT(1X,'ENTER PRINT OPTION AS FOLLOWS:',//%
7960. 4X,'1=DISPLAY MILITARY/CIVILIAN BREAKOUT',//%
7980. 4X,'2=DISPLAY TOTAL MANPOWER ONLY',//%
8000. 1X,'PRINT OPTION IS:')
8020.
8040. 610 CONTINUE
8060. READ(5,*)IOPT
8080. IF(10PT.GT.0.AND.10PT.LT.3)GO TO 620
8100. IF(10PT.EQ.199)STOP
8120. *RITE(6,9090)
8140. GO TO 610
8140.01 620 CONTINUE
8140.02 *R1IF(6,9330)
8140.03 9330 FORMAT(////)
8140.04 *RITE(6,9340)(CNAM(K),K=1,8)
8140.2 9340 FORMAT(31X,BAS//)
8140.4 *THE *ORKLOAD INDICATOR PRINTOUT WILL NOW BE MADE.
8140.6 *RITE(6,9330)
8140.8 WRITE(6,9410)
8141. 9410 FORMAT(34X,'OUTPUT/WORKLOAD'//)
8141.2 *R1IF(6,9420)
8141.4 9420 FORMAT(1X,'WORKLOAD INDICATOR',25X,'FY79',7X,'CHANGE',1X,'RESULTANT',2X,'PERCENT',//%
8141.6 DC 740 I=1,N3
8141.8 XPR1=CONST(1)
8142. XPR2=0
8142.2 IF(ANS(1).GT.0)GO TO 720
8142.4 WRITE(6,9070)(WNAMS(I,K),K=1,8)

```

```

8142.6      60 TO 740
8142.8      720 CONTINUE
8143.        DO 740 J=1,N
8143.2      XPR1=XPR1+XBASES*WIND(I,J)*XBAR(J)
8143.4      XPR2=XPR2+XBASES*WIND(I,J)*DELX(J)
8143.6      730 CONTINUE
8143.8      XPR3=XPR1+XPR2
8144.        PCNT=0
8144.2      IF(XPR1.NE.0) PCNT=XPR2/XPR1*100.
8144.4      WRITE(6,9430)(WNAMS(I,K),K=1,8),XPR1,XPR2,XPR3,PCNT
8144.6      9430 FORMAT(1X,8A5,1X,F10.1,1X,F9.1,1X,F10.1,1X,F6.1)
8144.8      740 CONTINUE
8160.      *THE TOTAL FUNCTIONAL MANPOWER PRINTOUT WILL NOW BE MADE.
8180.        DO 630 K=1,3
8200.          XTOT(K)=0
8220.        630 CONTINUE
8240.        WRITE(6,9350)
8260.        9350 FORMAT(/29X,'FUNCTIONAL MANPOWER (TOTAL)')
8300.        WRITE(6,9360)
8320.        9360 FORMAT(1X,'FUNCTION',36X,'F79',6X,'CHANGE',1X,'RESULTANT',1X,'PERCENT',%
8340.          '43X','MANPOWER',11X,'MANPOWER',2X,'CHANGE',/)
8360.        DO 650 I=1,M
8380.          XPCNT(I)=0
8400.          IF(XBAR(I).NE.0) XPCNT(I)=DELX(I)/XBAR(I)*100.
8420.          XPR(I,1)=XBAR(I)*XBASES
8440.          XPR(I,2)=DELX(I)*XBASES
8460.          XPR(I,3)=XPR(I,1)+XPR(I,2)
8480.          DO 640 K=1,3
8500.            XTOT(K)=XTOT(K)+XPR(I,K)
8520.          640 CONTINUE
8540.          WRITE(6,9370)(FNAM(I,K),K=1,8),(XPR(I,K),K=1,3),XPCNT(I)
8560.          9370 FORMAT(1X,8A5,1X,F9.1,1X,F8.1,1X,F9.1,2X,F7.2)
8580.          650 CONTINUE
8600.          PCNT=0
8620.          IF(XTOT(I).NE.0)PCNT=XTOT(2)/XTOT(1)*100
8640.          *RITE(6,9380)(XTOT(K),K=1,3),PCNT
8660.          9380 FORMAT(/6X,'TOTAL',31X,F9.1,1X,F8.1,1X,F9.1,2X,F7.2)
8680.          IF(10PT.FG.2)GO TO 715
8700.          *THE MILITARY & CIVILIAN FUNCTIONAL MANPOWER PRINTOUT WILL NOW BE MADE.
8720.          JO 685 KK=1,3
8740.          DO 680 KK=1,3
8760.            XTOT(K)=0
8780.            680 CONTINUE
8800.            WRITE(6,9330)
8820.            *RITE(6,9390)(MLCVGN(KK,II),I=1,2)
8840.            9390 FORMAT(12X,'FUNCTIONAL MANPOWER ('2A4,')')
8860.            *RITE(6,9360)
8880.            DO 680 I=1,M
8900.              XMPCNT(I,KK)=PCTMIL(I,KK)*XPCNT(I)/100.
8920.              DO 670 K=1,3
8940.                XMIL(I,K,KK)=PCTMIL(I,KK)*XPR(I,K)/100.
8960.                XTOT(K)=XTOT(K)+XMIL(I,K,KK)
8980.              670 CONTINUE
9000.              *RITE(6,9370)(FNAM(I,K),K=1,8),(XMIL(I,K,KK),K=1,3),XMPCNT(I,KK)
9020.              9370
9040.

```

```

9060.
9080.
9100.
9120.
9130.
9140.
9160.
9180.
9200.
9220.
9240.
9260.
9280.
9300.
9310.
9320.
9330.
9340.
9350.
9360.
9370.
9380.
9400.
9420.
9440.
9460.
9480.
9500.
9520.
9540.
9560.
9580.
9600.
9620.
9640.
9660.
9680.
9700.
9720.
10220.
10240.
10260.
10280.
10300.
10320.
10340.
10360.
10380.
10400.
10420.
10440.
10460.
10480.
10490.

680 CONTINUE
PCNT=0
IF(XTOT(1),IE,0)PCNT=XTOT(2)/XTOT(1)*100.
WRITE(6,9380)(XTOT(K),K=1,3),PCNT
685 CONTINUE
*THE CONTRACTOR FUNCTIONAL MANPOWER PRINTOUT WILL NOW BE MADE.
DO 690 K=1,3
XTOT(K)=0
690 CONTINUE
WRITE(6,9330)
WRITE(6,9400)
9400 FORMAT(27X,'FUNCTIONAL MANPOWER (CONTRACTOR)')
DO 710 I=1,M
WRITE(6,9360)
DO 695 KK=1,3
PCNT=XPCNT(I)-XPCNT(I,KK)
695 CONTINUE
DO 700 K=1,3
DO 696 KK=1,3
XPR(I,K)=XPR(I,K)-XPR(I,K,KK)
696 CONTINUE
XTOT(K)=XTOT(K)+XPR(I,K)
700 CONTINUE
WRITE(6,9370)(FNAM(I,K),K=1,8),(XPR(I,K),K=1,3),PCNT
710 CONTINUE
PCNT=0
IF(XTOT(1),NE,0)PCNT=XTOT(2)/XTOT(1)*100.
WRITE(6,9380)(XTOT(K),K=1,3),PCNT
715 CONTINUE
*SLACK VARIABLES WILL NOW BE PRINTED.
WRITE(6,9330)
WRITE(6,9405)
9405 FORMAT(30X,'MANPOWER SLACK VARIABLES')
WRITE(6,9406)
9406 FORMAT(1X,'FUNCTION',40X,'SLACK')
DO 717 I=1,M
WRITE(6,9407)(FNAM(I,K),K=1,8),X2(I,M)
9407 FORMAT(1X,8A5,3X,F10.2)
717 CONTINUE
IF(RASES.EQ.0)GO TO 750
ISUM=CSUM*BASES
IB=RASES
WRITE(6,9440)IB,ISUM
9440 FORMAT(11X,'THE CHANGE ACHIEVED BY OPENING ',I3,' BASE(S) IS ',I6)
750 CONTINUE
IF(ICNT.EQ.CMDS)GO TO 760
WRITE(6,9010)(DASH,K=1,16)
760 CONTINUE
LOOP=2
IF(CMDS.GT.1)GO TO 10
WRITE(6,9450)
9450 FORMAT(11X,'ENTER ITERATION OPTION AS FOLLOWS:1/%
3X,'1=ACCUMULATE CHANGES,2=BEGIN NEW CYCLE,3=STOP,/%
3X,'NOTE--ACCUMULATION CHANGES CANNOT RE 1/%

```

```

10491.
10500.
10520.
10540.
10560.
10580.
10600.
10620.
10640.
10660.

3X, 'MADE IN THE WORKLOAD OR MISSION MODE', %
3X, 'ITERATION OPTIONS', )

770 CONTINUE
READ(5,*) LOOP
GO TO (10,10,780), LOOP
WRITE(6,9040)
GO TO 770
780 CONTINUE
STOP 'RUN COMPLETE'
ENL

```

RAWIA

```

98.      C   A SUBROUTINE TO CHOOSE PIVOT ROW
99.      SUBROUTINE RAWIA(IP,IPASE)
100.      COMMON/INFO/A(25,50),B(25,25),IRAS(25),M,M1,M2,N,N1,EPS
101.      IP=-1
102.      Q=1.0E+20
103.      DO 33 I=1,M2
103.5     IF(I.LT.3.AND.IPASF.EQ.1)GO TO 33
103.6     IF(I.EQ.2.AND.IPASE.EQ.2)GO TO 33
104.     IF(R(I,M2))33,33,31
105.     31 QI=R(I,1)/R(I,M2)
106.     IF(QI-Q)32,33,33
107.     32 Q=QI
108.     IP=I
109.     33 CONTINUE
110.     RETURN
111.     END
```


REITA

```
125. C A SUBROUTINE TO CHOOSE THE COLUMN WITH THE LOWEST PRICE
126. SUBROUTINE REITA(IPASE,CD,JP)
127. COMMON/INFO/A(25,50),B(25,25),IBAS(25),M,M1,M2,N,N1,EPS
128. CD=0
129. DO 23 J=2,N1
130. CDJ=A(IPASE,J)
131. DO 21 I=3,M2
132. 21 CDJ=CDJ+B(IPASE,I-1)*A(I,J)
133. IF(CDJ-CD)22,23,23
134. 22 JP=J
135. CD=CDJ
136. 23 CONTINUE
137. RETURN
138. END
```

RIVO

```
112. C A SUBROUTINE TO PERFORM THE PIVOTING OPERATION
113. SUBROUTINE RIVO(IP,IPASE,IRV)
114. COMMON/INFO/A(25,50),B(25,25),IBAS(25),M,M1,M2,N,N1,EPS
115. PINV=1./B(IP,M2)
116. B(IP,M2)=0
117. DO 36 J=1,M1
118. C=B(IP,J)*PINV
119. B(IP,J)=C
120. DO 36 I=1,M2
121. 36 B(I,J)=B(I,J)-C*B(I,M2)
122. IBAS(IP)=IBV
123. RETURN
124. END
```

SUBLP

```

100. C A PROGRAM FOR THE REVISED SIMPLEX METHOD
200. C IT STORES THE INVERSE IN AN EXPLICIT FORM
300. C THE OBJECTIVE FUNCTION IS TO BE MINIMIZED
400. C
500. C SUBROUTINE SUBLP(X,OPT)
600. C COMMON/INP/O/A(25,50),B(25,25),IBAS(25),M,M1,M2,N,N1,EPS
700. C DIMENSION X(75)
800. C DATA NREADU//NPRINT/3/
900. C CALL MATGEN
1000. C CONSTRUCT THE FIRST WORKING TABLE AS AN M2*M2 TABLE
1100. C DO 19 I=3,M2
1200. C DC 18 J=2,M1
1300. C 16 B(I,J)=0
1400. C B(I,I)=1
1500. C B(I,1)=A(I,1)
1600. C IBAS(I)=N+I-2
1700. C B(I,I-1)=0
1800. C 19 B(2,I-1)=0
1900. C IBAS(1)=-1
2000. C IBAS(2)=0
2100. C B(1,1)=A(1,1)
2200. C B(2,1)=A(2,1)
2300. C START OF PHASE I
2400. C IPASE=1
2500. C CHOICE OF COLUMN WITH LOWEST PRICE
2600. C 20 CALL REITA(IPASE,CD,JP)
2700. C IBV=JP-1
2800. C IZ2=I22+1
2900. C TRANSIT FROM PHASE I TO PHASE II
3000. C IF(CD*EPS)28,24,24
3100. C 24 GO TO (25,45),IPASE
3200. C 25 B(1,1)=B(1,1)
3300. C IF(B(1,1)-EPS)26,26,41
3400. C 26 IPASE=2
3500. C GO TO 20
3600. C FORMATION OF THE EXTRA COLUMN AT THE EXTREME RIGHT OF THE B TABLE
3700. C 28 CONTINUE
3800. C DC 325 K=1,2
3900. C DC=A(K,JP)
4000. C 22B DC=CC*(K,1-1)+A(I,JP)
4100. C 32B B(K,M2)=DC
4200. C DO 30 I=3,M2
4300. C C=0
4400. C DC 29 J=3,M2
4500. C 29 C=C+B(I,J-1)*A(J,JP)
4600. C B(I,M2)=C
4700. C 30 CONTINUE
4800. C CHOOSE THE PIVOT COLUMN
4900. C CALL RAN1A(IP,IPASE)
5000. C IF(IP)34,34,35
5100. C 34 GO TO (52,37),IPASE
5200. C PERFORM THE PIVOTING OPERATION
5300. C 35 CALL RIVO(IP,IPASE,IRV)

```

```

5350.      9000 CONTINUE
5400.      GO TO 20
5500.      C  PROBLEM RESULTS FOLLOW
5600.      C  A) UNBOUND SOLUTION
5700.      37 WRITE(NPRINT,3) IBV
5800.      DO 39 I=2,M2
5900.      39 WRITE(NPRINT,4) IBAS(I),R(I,1),B(I,M2)
6000.      GO TO 55
6100.      C  B) INCONSISTENCY
6200.      41 WRITE(NPRINT,6) B(1,1),B(2,1)
6300.      NVAR=M+N
6400.      GO TO 47
6500.      C  C) OPTIMAL SOLUTION
6600.      45 OPT=B(2,1)
6700.      WRITE(NPRINT,7) OPT
6800.      NVAR=N
6900.      C  D) DETERMINATION OF THE X'S
7000.      47 DO 48 J=1,NVAR
7100.      48 X(J)=0
7200.      DO 49 I=1,M2
7300.      49 I=IBAS(I)
7350.      IF (IX.LC.0) GO TO 49
7400.      X(I)=X(I,1)
7450.      CONTINUE
7500.      C  OUTPUT OPTIMAL SOLUTION
7600.      DO 2000 I=1,NVAR
7700.      WRITE(NPRINT,*)X(I)
7800.      CONTINUE
7900.      GO TO 55
8000.      C  DISPLAY OF FAULTS (IF ANY)
8100.      52 WRITE(NPRINT,9) IPASE
8200.      55 WRITE(NPRINT,11)
8300.      RETURN
8400.      3 FORMAT(10X,'UNBOUND SOLUTION',X('I2','I')= INFINITY')
8500.      4 FORMAT(10X,'X('I2,')=,IPE20.8,X(E20.8,')T')
8600.      6 FORMAT(10X,'INCONSISTENT EQUATIONS, W=,IPE20.8,X, Z=,E20.8)
8700.      7 FORMAT('I,')9X,'OPTIMAL SOLUTION', Z=,IPE20.8)
8800.      9 FORMAT(10X,'FAULTY PROCESSING IN PHASE',I2)
8900.      11 FORMAT(10X,'END OF CALCULATIONS')
9000.      END

```

ANNEX 2

VARIABLE EXPLANATIONS

MISSUB

- NMISMP - Indicates number of mission manpower program elements.
- XMIS - Indicates FY79 values for each program element or mission component.
- PEC - Identifies the program element code for each program element.
- TITLS - Indicates the definition of each program element or mission component.
- NOTHM - Indicates number of other mission manpower program elements.
- NOTH - Indicates number of other mission capability components (except missiles).
- MNISSL - Indicates the number of missile mission components.
- NACRFT - Indicates the number of aircraft mission components.
- NEQU1 - Indicates the number of mission/mission equations.
- NSUBL - Indicates the matrix row number of the mission capability indicator to be modified in a given equation.
- NCOL - Indicates the number of mission components that produce changes in a given mission indicator.
- NSUBR - Indicates the matrix row identifying number of each mission component in a given equation.
- COEFF - Indicates the respective coefficients by which each mission component is to be multiplied.
- NEQU2 - Indicates the number of mission/workload equations.
- NSUBL2 }
NCOL2 } - Represent the same variables defined above, but as applied to
NSUBR2 } mission/workload equations.
COEFF2 }
- MTYPE - Indicates mission type.
- NCHG - Indicates number of force structure changes to be made for each type of force structure change.

ITEM - Indicates identifying number for each mission capability component changed.
 VALUE1 - Indicates numerical change in each mission capability component.
 VALUE2 - Indicates change in aircraft flying hours.
 IOPT - Indicates print option.
 ROLD - FY79 mission value.
 COLD - Change to FY mission value.
 RVAL - Resultant FY79 mission value.
 PCNT - Percent change of mission value.

NBOSPG

CMD - Indicates the command or commands to which changes are to be made.
 XBASES - Indicates number of bases changed.
 CSUM - Indicates the total base opening manpower requirement.
 M - Indicates the number of manpower functions contained in the data file (SACFL, TACFL, or ATCFL).
 N - Indicates the number of variables contained in the file.
 M2 - Indicates the number of equations contained in the file.
 ARG - Indicates the value of epsilon.
 N2 - Indicates the number of workload indicator variables.
 N3 - Indicates the number of output display lines.
 M3 - Indicates the number of manpower functions whose values are determined by the workload indicator variables.
 M4 - Indicates the number of equations that are included in the model in either the "mission" or "workload" modes.
 XBAR - Indicates FY79 value for each variable in the model (i.e., workload, manpower slack, and functional manpower variables).
 FUNC - Indicates the variable name for each manpower function.
 PCTMIL - Indicates the percentage manpower make-up of either officers, airmen, or civilians in a given manpower function
 CSUMY - Indicates the base opening cost for each manpower function.
 FNAM - Indicates the name for each manpower function.
 OBJ - Indicates each coefficient of the objective function.

RHS - Indicates the equation constant for each equation.
 C - Indicates the coefficient values for each equation.
 MOMIT - Indicates the identifying number of each manpower function having values determined by the workload indicator variables.
 MPIND - Indicates the column identifying number of each workload indicator variable.
 WNS - Indicates whether the line to be output will or will not contain data.
 WIND - Indicates the value of each workload indicator equation coefficient.
 CONST - Indicates the constant for each workload indicator equation.
 WNAMS - Indicates the name of each workload indicator.
 IOPTX - Indicates change option.
 ICOPT - Indicates the change option selected (manpower, workload, or mission).
 ABSCHG - Indicates the absolute change to total manpower entered.
 PRCNT - Indicates the percentage change to total manpower or workload.
 NFUNC - Indicates the number of functions for which changes are to be specified.
 DELX - Changes to XBAR input by the user.
 METH - Indicates the method by which function changes will be specified.
 IFUNCS - Indicates the identifying number of each function to be changed.
 AMOUNT - Indicates the amount by which each function is to be changed.
 IOPT - General optional selection variable (yes or no).
 BASES - Indicates the number of bases to be opened or closed.
 XVAL - Indicates change in mission population.
 NINDS - Indicates the number of workload indicators for which changes will be specified.
 INDW - Indicates identifying number of each workload indicator to be changed.
 LOOP - Indicates iteration option.
 XPR1 - Original workload value.
 XPR2 - Workload change outputs.
 XPR3 - Resultant workload value.
 PCNT - Percentage change in workload.

MATGEN

- N - Indicates the number of variables.
- M - Indicates the number of constraints.
- EPS - Indicates the value of epsilon.
- A - Indicates the cost coefficients for the objective function, the constraint constants, and the constraint variable coefficients.
- IBAS - The vectors contained in the basis.

SUBLP

- X - Linear program solution vector.
- B - Linear program basis vector.

APPENDIX E
GEBOS-M DATA FILES

This appendix documents the Mission Data Files and the Manpower and Workload Data Files not already described in detail in Section 5 of this report. Data file names appear below; data file listings are detailed at the points indicated.

<u>Data</u>		<u>Location of</u>
<u>File Name</u>	<u>Description</u>	<u>Detailed Listing</u>
SACOP	SAC Operational Mission	Section 5.3
TACOP	TAC Operational Mission	Figure E.1
ATCOP	ATC Operational Mission	Figure E.2
SACFL	SAC Manpower and Workload	Figure E.3
TACFL	TAC Manpower and Workload	Figure E.4
ATCFL	ATC Manpower and Workload	Section 5.4

The variables employed in the SACOP, TACOP, and ATCOP data files are identified in Section 5 of this report, with supplementary identification for TACOP and ATCOP appearing at the beginning of the detailed listings in Figures E.1 and E.2.

The variables employed in SACFL, TACFL, and ATCFL are defined in Table 2.3, Section 2 of this report.

```

LIST TACOP
10      TACTICAL AIR COMMAND
20      OPERATIONAL MISSION CAPABILITY
30      11
40          332.0 21130 AIRBORNE COMMAND POST (CINCLANT)
50          1678.0 27121 A-7 SQUADRONS
60          486.0 27127 F-105 SQUADRONS
70          10533.0 27128 F-4 SQUADRONS
80          3809.0 27129 F-111 SQUADRONS
90          3632.0 27130 F-15 SQUADRONS
100         1349.0 27131 A-10 SQUADRONS
110         2511.0 27213 RF-4 SQUADRONS
120         657.0 27218 TACTICAL FIGHTER TNG (AGGRESSOR) SQUAD
130         3768.0 27412 TACTICAL AIR CONTROL SYSTEM
131         44151.0 ----- OTHER MISSION MANPOWER
140      15
150          215.0 27236 OPERATIONAL HEADQUARTERS (TAF)
160          1577.0 27241 SPECIAL OPERATIONS FORCE
170          572.0 27422 TACTICAL AIR CONTROL SYSTEM COMMAND
180          932.0 27428 TACTICAL FIGHTER WEAPONS CENTER RANGE
190          400.0 27430 CIVIL ENGINEER SQUADRONS (AW REPAIR)
200          468.0 27431 TACTICAL AIR INTELLIGENCE SYS ACTIVITIES
210          13049.0 27597 TRAINING-TACTICAL AIR FORCES
220          2424.0 27598 MGT HQ (TACTICAL AIR FORCES)
230          694.0 28015 COMBAT DEVELOPMENTS
240          360.0 28031 ARM-EQUIPMENT/SECONDARY ITEMS
250          340.0 27711 CARE IN REGIONAL DEFENSE FACILITIES
260          664.0 27715 DENTAL CARE ACTIVITIES
270          3926.0 27792 STATION HOSPITALS AND MEDICAL CLINICS
280          2601.0 ----- OTHER TAC
290          15929.0 ----- TENANT MANPOWER
300      11
310          27020.0 MILITARY HOUSING FLOOR SPACE
320          39627.0 NON-HOUSING FLOOR SPACE
330          497.0 MILITARY VEHICLES
331              1.0 A-7 SQUADRONS
332              2.0 A-10 SQUADRONS
333              8.0 F-4 SQUADRONS
334              2.0 RF-4 SQUADRONS
335              4.0 F-15 SQUADRONS
336              1.0 F-105 SQUADRONS
337              1.0 F-5 SQUADRONS
338              2.0 F-111 SQUADRONS
340      0
350      22

```

Figure E.1. Listing of Mission Data File TACOP

360	72.0	26311.0	15995.0	A-7D
370	122.0	62221.0	32557.0	A-10A
380	55.0	16375.0	12637.0	F-4C
390	139.0	33675.0	26735.0	F-4D
400	317.0	82895.0	63433.0	F-4E
410	225.0	55293.0	41233.0	F-15A
420	59.0	12116.0	3924.0	F-15B
430	47.0	8309.0	7837.0	F-104G
440	23.0	4384.0	3666.0	F-105F/G
450	162.0	33963.0	14536.0	F-111A/D
460	134.0	35736.0	22319.0	RF-4C
470	10.0	4229.0	1195.0	AC-130H
480	85.0	33372.0	17016.0	D-2A
490	11.0	4827.0	2332.0	OV-10A
500	3.0	975.0	264.0	EC-135P
510	18.0	6663.0	6859.0	UH-1H/P
520	8.0	2415.0	1687.0	CH-3
530	4.0	568.0	317.0	CH-53
540	32.0	28411.0	28464.0	T-38A
550	108.0	9316.0	10369.0	T-38B
560	44.0	12649.0	13433.0	F-5E
570	5.0	2913.0	953.0	MC-130E
580	33			
581	11 15			
582	12 1.0 13 1.0 14 1.0 15 1.0 16 1.0			
583	17 1.0 18 1.0 19 1.0 20 1.0 21 1.0			
584	22 1.0 23 1.0 24 1.0 25 1.0 26 1.0			
590	1 1			
600	52 110.67			
610	2 2			
620	30 375.04 38 18.19			
630	3 2			
640	35 375.04 46 4.82			
650	4 4			
660	32 375.04 40 22.68 41 22.68 42 22.68			
670	5 2			
680	37 375.04 47 27.60			
690	6 3			
700	34 375.04 43 39.99 44 39.99			
710	7 2			
720	31 375.04 39 14.73			
730	8 2			
740	33 375.04 48 18.96			
750	9 2			
760	36 375.04 53 6.41			
770	10 1			
780	50 10.79			
790	82 1			
800	60 .608			

Figure E.1 (Continued)

810	83 1
820	61 .523
830	84 1
840	62 .772
850	85 1
860	63 .795
870	86 1
880	64 .765
890	87 1
900	65 .746
910	88 1
920	66 .737
930	89 1
940	67 .943
950	90 1
960	68 .836
970	91 1
980	69 .428
990	92 1
1000	70 .625
1010	93 1
1020	71 .283
1030	94 1
1040	72 .510
1050	95 1
1060	73 .483
1070	96 1
1080	74 .271
1090	97 1
1100	75 .792
1110	98 1
1120	76 .699
1130	99 1
1140	77 .538
1150	100 1
1160	78 1.002
1170	101 1
1180	79 1.113
1190	102 1
1200	80 1.062
1210	103 1
1220	91 .327
1230	6
1240	22 1
1250	27 1.0
1260	23 1
1270	28 1.0
1280	26 6

Figure E.1 (Continued)

1290	31	400.5	32	1399.5	33	2990.8	34	3054.6	37	1544.0	26	2.2776
1300	27	1										
1310	29	1.0										
1320	28	22										
1330	60	.034	61	.0293	62	.0432	63	.0445	64	.0428		
1340	65	.0417	66	.0412	67	.0528	68	.0468	69	.024		
1350	70	.035	71	.0159	72	.0285	73	.0269	74	.0152		
1360	75	.0443	76	.0391	77	.0312	78	.0561	79	.0623		
1370	80	.0594	81	.0183								
1380	31	22										
1390	60	.0571	61	.04292	62	.1296	63	.1279	64	.1308		
1400	65	.1163	66	.11625	67	.0667	68	.1071	69	.125		
1410	70	.1113	71	.0588	72	.0021	73	.0079	74	.1625		
1420	75	.0075	76	.0125	77	.0242	78	.0325	79	.0325		
1430	80	.0479	81	.0646								

Figure E.1 (Continued)

```

!LIST ATCOP
 10      AIR TRAINING COMMAND
 20      OPERATIONAL MISSION CAPABILITY
 30      11
 40          368.0 81714 PERSONNEL PROCESSING ACTIVITIES
 50          839.0 84711 RECRUIT TRAINING UNITS
 60          2874.0 84721 SERVICE ACADEMY
 70          7427.0 84731 GENERAL SKILL TRAINING
 80          144.0 84733 GENERAL INTELLIGENCE SKILL TRAINING
 90          426.0 84734 CRYPTO/IGINT RELATED SKILL TRAINING
100          4847.0 84741 UNDERGRADUATE PILOT TRAINING
110          657.0 84742 UNDERGRADUATE NAVIGATOR/NOF TRAINING
120          677.0 84743 OTHER FLIGHT TRAINING
130          429.0 84751 PROFESSIONAL MILITARY EDUCATION
135          33861.0 ----- OTHER MISSION MANPOWER
140      10
150          336.0 84752 OTHER PROFESSIONAL EDUCATION
160          615.0 84771 SUPPORT OF TRAINING ESTABLISHMENT
170          1345.0 85798 MANAGEMENT HEADQUARTERS (TRAINING)
180          459.0 86761 EDUCATION/TRAINING (HEALTH CARE)
190          1175.0 87711 CARE IN REGIONAL DEFENSE FACILITIES
200          581.0 87715 DENTAL CARE ACTIVITIES
210          2922.0 87792 STATION HOSPITALS AND MEDICAL CLINICS
220          220.0 88716 OTHER PERSONNEL ACTIVITIES
230          1343.0 ----- OTHER ATC MANPOWER
240          24205.0 ----- TENANT MANPOWER
250      11
260          9876.0 RECRUIT TRAINING WORKLOAD
270          25191.0 TECHNICIAN TRAINING WORKLOAD
280          672.0 CRYPTO/INTELLIGENCE TRAINING WORKLOAD
290          1942.0 PILOT TRAINING WORKLOAD
300          762.0 NAVIGATOR TRAINING WORKLOAD
310          4499.0 CADET TRAINING WORKLOAD
320          1569.0 PROFESSIONAL EDUCATION TRAINING WORKLOAD
330          19589.0 MILITARY HOUSING FLOOR SPACE
340          52008.0 NON-HOUSING FLOOR SPACE
350          157.0 MILITARY VEHICLES
351          7.0 FLIGHT TRAINING SQUADRONS
360      0
370      4

```

Figure E.2. Listing of Mission Data File ATCOP

380	511.0	238639.0	212209.0	T-37E
390	536.0	222321.0	227927.0	T-38A
400	112.0	19321.0	15075.0	T-41A/C
410	12.0	10097.0	2604.0	T-43A
420	23			
430	1 1			
440	22 .0569			
450	2 1			
460	22 .1296			
470	3 1			
480	27 1.02			
490	4 1			
500	23 .451			
510	5 1			
520	24 .3868			
530	6 1			
540	24 1.1442			
550	7 3			
560	33 3.352 34 3.352 25 1.55			
570	8 2			
580	36 36.88 26 .581			
590	9 3			
600	33 .468 34 .468 25 .2167			
610	10 1			
620	28 .8921			
630	11 10			
640	12 1.0 13 1.0 14 1.0 15 1.0 16 1.0			
650	17 1.0 18 1.0 19 1.0 20 1.0 21 1.0			
660	25 2			
670	33 2.16 34 2.16			
680	26 1			
690	36 63.50			
690.1	33 1			
690.2	25 .2264			
690.3	34 1			
690.4	25 .2366			
690.5	36 1			
690.6	26 .01575			
690.7	37 1			
690.8	25 132.4			
690.9	38 1			
691	25 125.3			
691.1	40 1			
691.2	26 13.25			
700	41 1			
710	25 106.0			
720	42 1			
730	25 101.2			
740	43 1			
750	39 .7862			

Figure E.2 (Continued)

760	44	1								
770	26	3.42								
780	7									
790	22	1								
800	29	1.0								
810	24	9								
820	21	.3601	22	.4689	23	.4689	24	.4689	25	.4689
830	26	.4689	27	.4689	28	.4689	32	1344.0		
840	25	4								
850	37	.015	38	.0325	39	.0007	40	.0708		
860	27	7								
870	22	1.0	23	1.0	24	1.0	25	1.0	26	1.0
880	27	1.0	28	1.0						
881	29	10								
882	22	22.16	23	22.16	24	22.16	27	22.16	25	22.16
883	28	22.16	33	47.87	34	47.87	36	1407.16		
890	31	1								
900	30	1.0								
910	32	1								
920	31	1.0								

Figure E.2 (Continued)

LIST SACFL

20	1,633.2
40	STRATEGIC AIR COMMAND
60	10. 34. 22. .05 6. 41. 2. 16.
80	2448.
100	1384.
120	2757.
140	7104.
160	7753.
180	2232.
200	7463.
220	324.
240	906.
260	2481.
280	0.
300	0.
320	0.
340	0.
360	0.
380	0.
400	0.
420	0.
440	0.
460	0.
480	132349.4
500	52939.8
520	71110.
540	106177.4
560	73087.3
580	109546.
600	424452.
620	174723.1
640	145.
660	26346.8
680	1751.
681	0.
682	64873.4
683	0.

Figure E.3: Listing of Manpower and Workload Data File SACFL

700	'V3'	2.81	48.06	41.67	99.9
720	MAINTENANCE & REPAIR OF REAL PROPERTY				
740	'V4'	0.	44.06	53.93	34.8
760	OPERATION OF UTILITIES FOR ALL REAL PROPERTY				
780	'V5'	2.13	49.37	39.07	62.5
800	OTHER ENGINEERING SUPPORT				
820	'V6'	9.15	70.58	20.20	0.
840	ADMINISTRATION				
860	'V7'	3.86	77.92	19.22	165.
880	RETAIL SUPPLY OPERATIONS				
900	'V8'	.18	53.09	43.64	0.
920	MAINTENANCE OF INSTALLATION EQUIPMENT				
940	'V9'	6.17	82.77	9.51	193.
960	OTHER BASE SERVICES				
980	'V10'	0.	83.64	16.36	0.
1000	BACHELOR HOUSING OPERATIONS & FURNISHINGS				
1020	'V11'	5.74	59.38	34.88	0.
1040	MORALE, WELFARE, & RECREATION				
1060	'V12'	5.97	60.18	4.10	78.
1080	OTHER PERSONNEL SUPPORT				

Figure E.3 (Continued)

Figure E.3 (Continued)

Figure E.3 (Continued)

3240	1.	
3260	0. 0. 0. 0. 199.1025 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		-170577.07
3280	SUPPLY TRANSACTIONS	
3300	1.	
3320	0. 0. 0. 0. 27.4329 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		-23502.58
3340	EQUIPMENT TRANSACTIONS	
3360	1.	
3380	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
3400	TOTAL ITEM RECORDS	
3420	1.	
3440	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		13466
3460	SUPPLY ITEM RECORDS	
3480	1.	
3500	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		1534
3520	EQUIPMENT ITEM RECORDS	
3540	1.	
3560	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
3580	AVIATION FUEL CONSUMPTION	
3600	0.	
3620	MAINTENANCE OF INSTALLATION EQUIPMENT	
3640	1.	
3660	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 1. 0. 0. 1. 0. 0.		
3680	MILES DRIVEN	
3700	1.	
3720	0. 0. 0. 0. 0. 9.9795 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		12120.76
3740	VEHICLE EQUIVALENTS	
3760	1.	
3780	0. 0. 0. 0. 0. 5.0312 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		4814.14
3800	TOTAL VEHICLES	
3820	1.	
3840	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 1. 0. 0. 0. 0. 0. 0.		
3860	MILITARY VEHICLES	

Figure E.3 (Continued)

3880	1.	
3900	0. 0. 0. 0. 0. 5.0313 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
3900	0. 0. 0. 0. 0. 0. -1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	4814.14
3920	NON-MILITARY VEHICLES	
3940	0.	
3960	BACHELOR HOUSING	
3980	1.	
4000	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
4000	0. 0. 0. 0. 0. 0. 0. 1. 0. 0. 0. 0.	
4020	VISITING AIRMEN BEDS	
4040	0.	
4060	OTHER PERSONNEL SUPPORT	
4080	1.	
4100	0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
4100	0. 0. 0. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
4120	WEIGHTED RATINGS	

Figure E.3 (Continued)


```

!LIST TACFL
  20      1,723.2
  40      TACTICAL AIR COMMAND
  60      10. 35. 23. .04 6. 41. 2. 16.
  80      5422.
 100      1088.
 120      2089.
 140      4648.
 160      5910.
 180      1082.
 200      4582.
 220      207.
 240      642.
 260      1862.
 280      0.
 300      0.
 320      0.
 340      0.
 360      0.
 380      0.
 400      0.
 420      0.
 440      0.
 460      0.
 480      100435.6
 500      27019.2
 520      39628.
 540      83763.3
 560      334274.5
 580      151017.8
 600      497.
 620      37167.
 640      1663.
 640.5    5910.
 641      54731.
 642      0.
 643      0.
 644      0.
 645      0.

```

Figure E.4. Listing of Manpower and Workload Data File TACFL

660	'V3'	2.03	55.95	39.91	178.9
680	MAINTENANCE & REPAIR OF REAL PROPERTY				
700	'V4'	0.	42.3	57.7	16.9
720	OPERATION OF UTILITIES FOR ALL REAL PROPERTY				
740	'V5'	1.78	43.88	38.08	91.4
760	OTHER ENGINEERING SUPPORT				
780	'V6'	10.11	65.28	24.59	0.
800	ADMINISTRATION				
820	'V7'	3.15	77.73	19.12	165.
840	RETAIL SUPPLY OPERATIONS				
860	'V8'	1.52	76.90	19.08	0.
880	MAINTENANCE OF INSTALLATION EQUIPMENT				
900	'V9'	4.83	81.51	12.57	193.
920	OTHER BASE SERVICES				
940	'V10'	0.	58.45	41.55	0.
960	BACHELOR HOUSING OPERATIONS & FURNISHINGS				
980	'V11'	5.13	54.19	40.68	0.
1000	MORALE, WELFARE, & RECREATION				
1020	'V12'	5.24	50.7	7.61	78.
1040	OTHER PERSONNEL SUPPORT				

Figure E.4 (Continued)

1500	2.	6.
1540	22.	
1580	MILITARY FAMILY HOUSING FLOOR SPACE	
1580	23.	
1600	NON-HOUSING FLOOR SPACE	
1700	26.	
1720	TOTAL ITEM RECORDS	
1740	27.	
1760	MILITARY VEHICLES	
1780	28.	
1800	MILES DRIVEN	
1820	31.	
1820	AVIATION FUEL CONSUMPTION	
1860	0.	
1880	POPULATION INDICATORS	
1900	1.	
1920	0. 1. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
1940	TOTAL BASE POPULATION	
1944	1.	
1946	-1. -1. -1. -1. -1. -1. -1. -1. -1. -1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
1948	TOTAL BASE MISSION POPULATION	
1960	1.	
1980	0. 0.	
1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
2000	TOTAL BASE MILITARY POPULATION	
2020	1.	
2040	0. 1. 0. 0.	
-1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
2060	TOTAL BASE CIVILIAN POPULATION	
2080	1.	
2100	0. 0.	
.3614 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
2120	TOTAL BASE AIRMEN POPULATION	
2140	1.	
2160	1. 1. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
2180	TOTAL RPM MANPOWER	
2200	1.	
2220	0. 0. 0. 1. 1. 1. 1. 1. 1. 1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
2240	TOTAL BOS MANPOWER	
2260	0.	
2280	REAL PROPERTY MAINTENANCE	
2300	1.	
2320	0. 1. 0.	
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.		
2340	MILITARY FAMILY HOUSING FLOOR SPACE	

Figure E.4 (Continued)

Figure E.4 (Continued)

Figure E.4 (Continued)

3650	1.	
3680	0.	0. 0.
0. 0.	0. 1.	0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
3700		MILITARY VEHICLES
3720	1.	
3740	0.	0. 0. 0. 0. 0. 7.4204 0. 0. 0. 0. 0. 0. 0. 0. 0. -7.4204 0. 0. 0. 0.
0. 0.	0. 0.	0. 0. -1. 0. 0. 0. 0. 0. 0. 0. 0. 0. 1266.127
3760		NON-MILITARY VEHICLES
3780	0.	
3800		BACHELOR HOUSING
3820	1.	
3840	0.	0. 0.
0. 0.	0. 0.	0. 0. 1. 0. 0. 0. 0. 0. 0. 0.
3860		VISITING AIRMEN BEDS
3880	0.	
3900		OTHER PERSONNEL SUPPORT
3920	1.	
3940	0.	0. 0.
0. 1.	0. 0.	0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
3960		WEIGHTED RATIONS

Figure E.4 (Continued)